

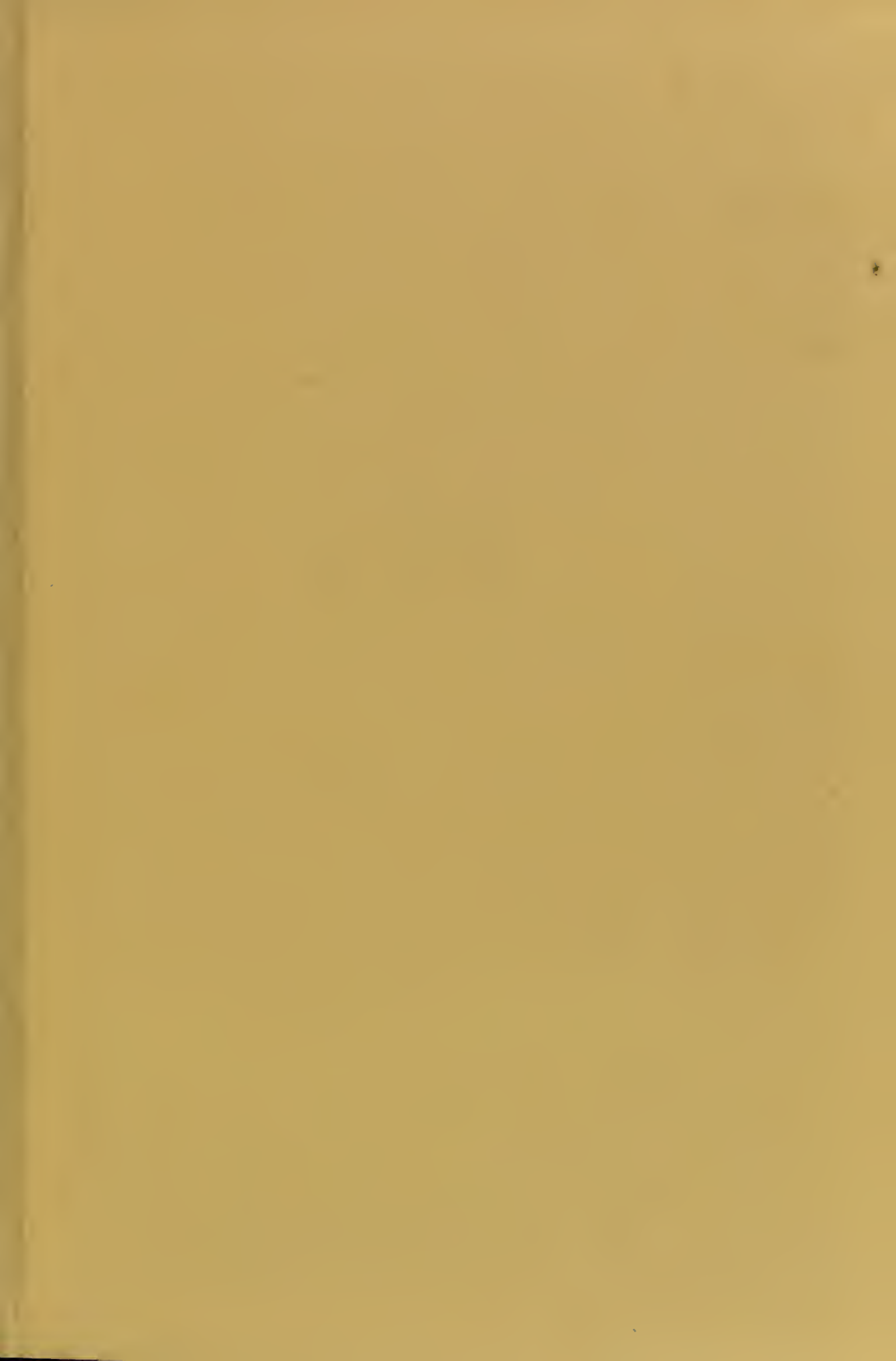
GENERAL & DESCRIPTIVE  
ANATOMY  
OF THE  
DOMESTIC ANIMALS  
BY  
JOHN GAMGEE & JAMES LAW

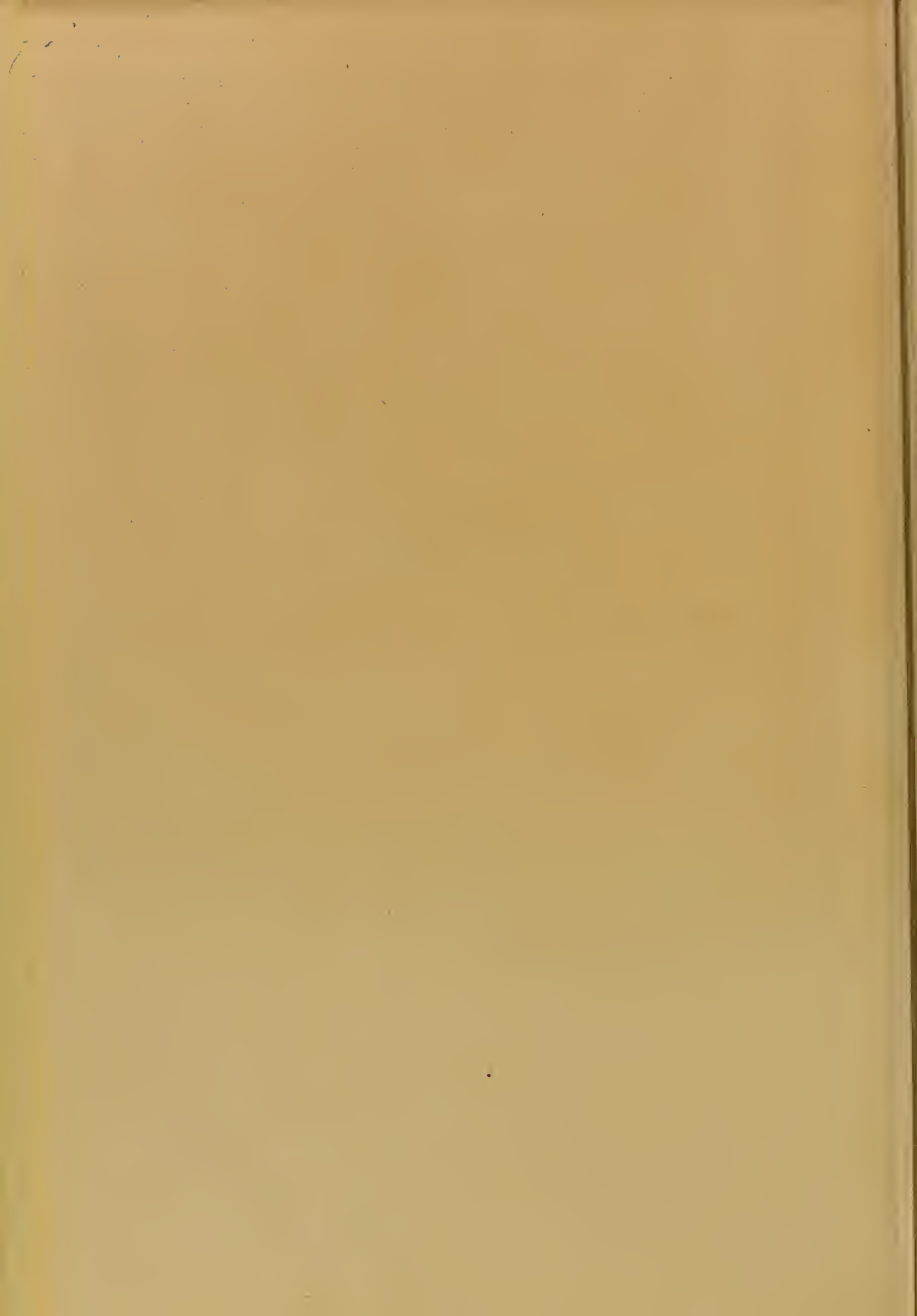


10/6

Ch 6. 19<sup>2</sup>

R 34350



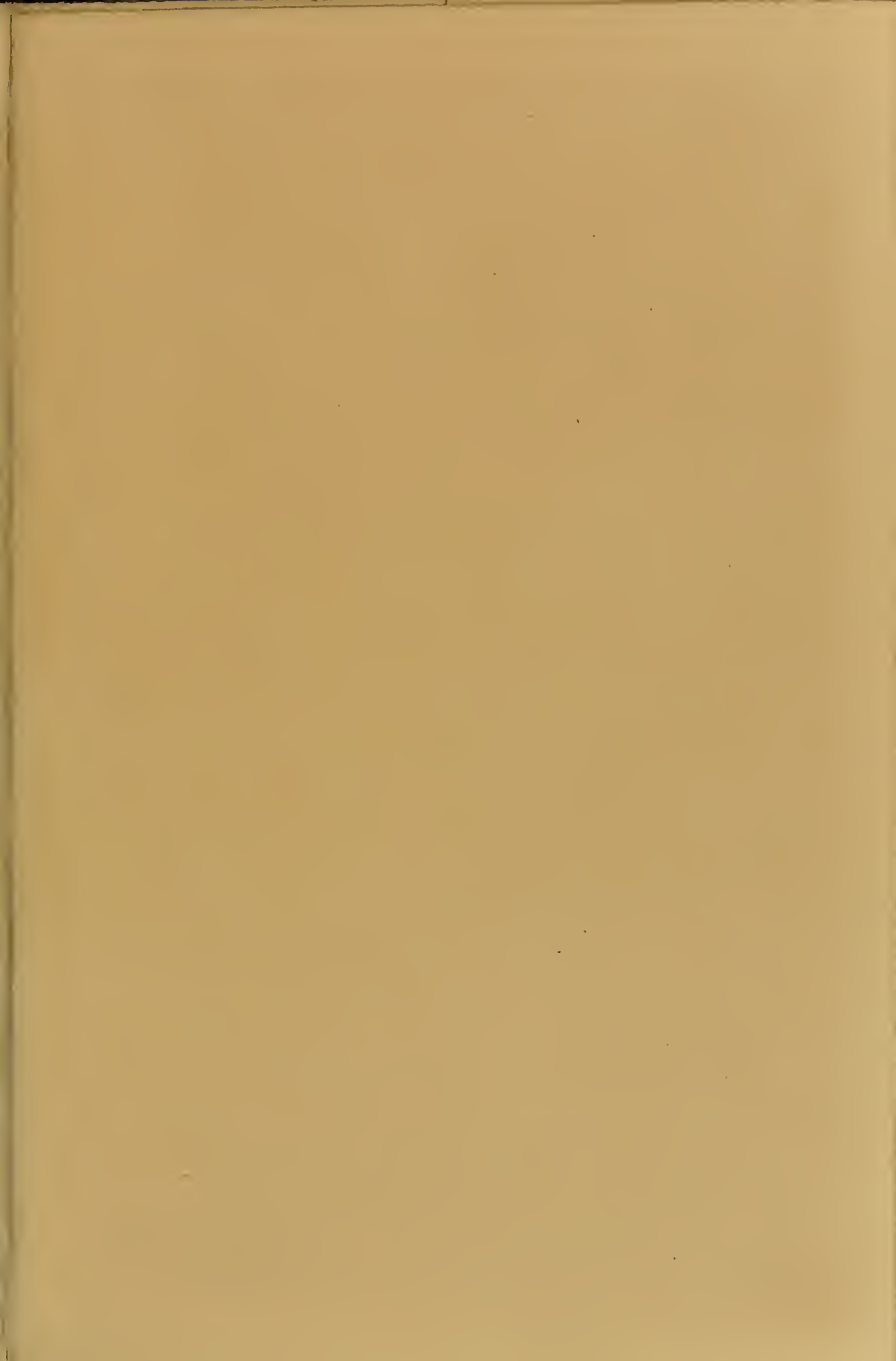




GENERAL  
AND  
DESCRIPTIVE ANATOMY  
OF THE  
DOMESTIC ANIMALS.

















GENERAL  
AND  
DESCRIPTIVE ANATOMY  
OF THE  
DOMESTIC ANIMALS.

BY  
JOHN GAMGEE,  
PRINCIPAL OF THE NEW VETERINARY COLLEGE, EDINBURGH;  
AND  
JAMES LAW,  
PROFESSOR IN THE NEW VETERINARY COLLEGE, EDINBURGH.

VOL. I.

PART II.—ARTICULATIONS AND MUSCULAR SYSTEM.

WITH NUMEROUS ILLUSTRATIONS.

EDINBURGH:  
THOMAS C. JACK, 92, PRINCES STREET.  
LONDON: SIMPKIN, MARSHALL, AND CO.

MDCCCLXII.

EDINBURGH :  
PRINTED BY ANDREW JACK,  
CLYDE STREET,



## LIST OF ILLUSTRATIONS IN VOL. I.

Plate I.	Frontispiece to Part I.	. . . . .	Skeleton of Eclipse.
„ II.	„	Part II. . . . .	Engraving of the Muscles.

FIG.		PAGE.
1.	Cells with nuclei and nucleoli . . . . .	18
2.	Granules of fatty matter . . . . .	25
3.	Air-bubbles . . . . .	<i>ib.</i>
4.	Spherical globules of phosphate of lime, and crystals of cholesterine . . . . .	<i>ib.</i>
5.	Milk globules . . . . .	26
6.	Globules and granules in cells . . . . .	<i>ib.</i>
7.	Granules of urate of ammonia . . . . .	27
8.	Gastric tubules from the pig's stomach . . . . .	29
9.	Spheroidal cells from sheep's pancreas . . . . .	30
10.	Columnar epithelium . . . . .	34
11.	Ciliated epithelium . . . . .	35
12.	Tesselated epithelium . . . . .	38
13.	Scaly epithelium . . . . .	<i>ib.</i>
14.	„ „ showing a gradual flattening . . . . .	39
15.	Pigment cells from the choroid . . . . .	40
16.	Hair follicle, showing the relations of the bulb and papilla . . . . .	42
17.	Stem of wool, showing its imbricated scales . . . . .	<i>ib.</i>
18.	Transverse section of a hair in its follicle . . . . .	43
19.	Horny scales . . . . .	44
20.	Horn fibres from the wall of the hoof . . . . .	45
21.	Transverse section of horn fibres . . . . .	<i>ib.</i>
22.	Frog of the horse . . . . .	46
23, 24.	Mare's hoof overgrown . . . . .	48
25.	Abnormal development of the cellular horny matrix in front of the laminae . . . . .	<i>ib.</i>
26.	Half of os pedis, atrophied . . . . .	<i>ib.</i>
27.	Half of a healthy os pedis . . . . .	<i>ib.</i>
28.	Natural position of the os pedis in relation to the healthy hoof . . . . .	<i>ib.</i>
29.	„ connective tissue from the embryo of a pig . . . . .	51
30.	Diagram showing the development of connective tissue, from connective tissue corpuscles . . . . .	<i>ib.</i>
31.	Fibrous tissue from sheep's leg . . . . .	54
32.	„ „ from the tendon of a kitten . . . . .	<i>ib.</i>
33.	Yellow fibrous tissue from the ligamentum nuchae . . . . .	56
34.	Elastic network from the pulmonary artery . . . . .	<i>i .</i>
35.	„ „ from the carotid . . . . .	<i>ib.</i>
36.	Reticulated tissue of the umbilical cord . . . . .	57
37.	Adipose tissue from the sheep's foot . . . . .	58
38.	„ „ from the abdominal cavity . . . . .	59
39.	„ „ with injected vessels . . . . .	<i>ib.</i>
40.	Cartilage from the fetlock joint . . . . .	61
41.	Section through the growing cartilage of a patella . . . . .	<i>ib.</i>

FIG.	PAGE.
42. Yellow cartilago from the epiglottis . . . . .	61
43. Lacunæ of bone . . . . .	64
44. Plain muscular fibres . . . . .	70
45. Fibrillæ of voluntary muscle . . . . .	<i>ib.</i>
46. Termination of muscular fibre in tendon . . . . .	<i>ib.</i>
47. Nerve cell . . . . .	71
48. Tubular or white nerve fibres . . . . .	72
49. Gelatinous nerve fibres . . . . .	73
50. Rib with the earthy matter removed . . . . .	78
51. Transverse section of horse's radius . . . . .	81
52. Section, showing Haversian canal and concentric lamellæ of bone . . . . .	82
53. Bony lamella, showing its reticular structure . . . . .	83
54. Cartilage undergoing ossification . . . . .	85
55. Section of frontal bone, showing ossification in membrane . . . . .	86
56. Ossification in an embryo parietal bone . . . . .	87
57. Skeleton of the cow . . . . .	91
58. „ of the pig . . . . .	92
59. „ of the dog . . . . .	93
60. „ of the cat . . . . .	94
61. Typical vertebra . . . . .	96
62. Thoracic vertebra . . . . .	97
63. Cranial vertebra . . . . .	98
64. Lumbar vertebra . . . . .	<i>ib.</i>
65. Cervical vertebra . . . . .	102
66. Anterior view of the atlas . . . . .	103
67. Upper view of the same . . . . .	<i>ib.</i>
68. Side view of the dentata . . . . .	105
69. Anterior view of the same . . . . .	<i>ib.</i>
70. Side view of a dorsal vertebra . . . . .	109
71. Anterior view of the same . . . . .	<i>ib.</i>
72. Front view of a lumbar vertebra . . . . .	112
73. Side view of the sacrum . . . . .	114
74. View of the lower aspect of the same . . . . .	<i>ib.</i>
75. Coccygeal vertebra . . . . .	117
76. Posterior view of the occiput . . . . .	121
77. Anterior view of the same . . . . .	<i>ib.</i>
78. Superior aspect of the parietal bone . . . . .	125
79. Internal aspect of the frontal bone . . . . .	127
80. External aspect of the same . . . . .	<i>ib.</i>
81. Vertical section of the horse's skull . . . . .	130
82. Upper surface of the sphenoid bone . . . . .	135
83. Side view of the sphenoid . . . . .	<i>ib.</i>
84. Squamous portion of the temporal bone . . . . .	139
85, 86. Tuberos portion of the same . . . . .	140
87. Superior maxillary bone . . . . .	144
88. Anterior maxillary bone . . . . .	147
89. Nasal bone . . . . .	148
90. Lachrymal bone . . . . .	150
91. Malar bone . . . . .	151
92. Palatine bone . . . . .	153
93. Pterygoid bones . . . . .	154
94. Vomer . . . . .	155
95. Inferior maxillary bone . . . . .	158
96. Hyoid bone, with its cornua—side view . . . . .	161
97. Lower surface of the hyoid bone . . . . .	<i>ib.</i>
98. „ aspect of the skull, minus the lower jaw . . . . .	165
99. Upper aspect of the skull . . . . .	<i>ib.</i>
100. „ surface of the sternum . . . . .	173
101. Dorsal vertebra, showing the sides of the ribs . . . . .	173
102. „ „ showing the front of the ribs . . . . .	<i>ib.</i>

FIG.	PAGE.
103. Sternal rib . . . . .	177
104. Asternal rib . . . . .	<i>ib.</i>
105. Inner surface of the scapula . . . . .	181
106. Outer aspect of the same . . . . .	<i>ib.</i>
107. Glenoid cavity and coracoid process . . . . .	<i>ib.</i>
108. Internal aspect of the humerus . . . . .	184
109. Anterior aspect of the same . . . . .	<i>ib.</i>
110. External aspect of the same . . . . .	<i>ib.</i>
111. Radius and ulna . . . . .	188
112. Posterior view of the metacarpal bones . . . . .	195
113. External view of the same . . . . .	<i>ib.</i>
114. Posterior view of the pastern bone . . . . .	198
115. Side view of the same . . . . .	<i>ib.</i>
116. Anterior view of the same . . . . .	<i>ib.</i>
117. „ aspect of the sesamoid bones . . . . .	199
118. Posterior aspect of the same . . . . .	<i>ib.</i>
119. „ surface of the os coronæ . . . . .	200
120. Side view of the same . . . . .	<i>ib.</i>
121. Front view of the same . . . . .	<i>ib.</i>
122. „ „ of the os pedis . . . . .	201
123. Lower surface of the same . . . . .	<i>ib.</i>
124. Lateral aspect of the same . . . . .	202
125. Section of the same, showing the semicircular canal . . . . .	<i>ib.</i>
126. Side view of the navicular bone . . . . .	203
127. Front view of the same . . . . .	<i>ib.</i>
128. Back view of the same . . . . .	<i>ib.</i>
129. Innominate bone of the ox . . . . .	207
130. „ „ of the horse . . . . .	<i>ib.</i>
131. Internal surface of the femur . . . . .	212
132. External aspect of the same . . . . .	<i>ib.</i>
133. Front view of the tibia and fibula . . . . .	215
134. Outer view of the same . . . . .	<i>ib.</i>
135. Back view of the same . . . . .	<i>ib.</i>
136. Patella—lateral and posterior views . . . . .	217
137. Synovial bursa abnormally distended . . . . .	240
138. Vertebrae, with inferior common ligament . . . . .	246
139. Intervertebral substance . . . . .	<i>ib.</i>
140. Vertebrae, showing the superior common ligament . . . . .	<i>ib.</i>
141. Ligamentum nuchæ . . . . .	247
142. Vertebrae, showing the continuation of the superior common with the odontoid ligaments . . . . .	249
143. Vertebrae, showing the inferior axoido-atloid ligament . . . . .	250
144. Ligaments of the two first cervical joints . . . . .	<i>ib.</i>
145. Temporo-maxillary joint . . . . .	254
146. Costo-vertebral joints, showing the interarticular ligament . . . . .	257
147. „ „ lower aspect . . . . .	<i>ib.</i>
148. Sternum, showing the costo-sternal joints . . . . .	258
149. Shoulder joint . . . . .	260
150. Elbow joint—posterior aspect . . . . .	262
151. „ „ anterior view . . . . .	263
152. Knee joint—front view . . . . .	268
153. „ „ back view . . . . .	<i>ib.</i>
154. „ „ postero-internal view . . . . .	269
155. „ „ external view . . . . .	<i>ib.</i>
156. Phalangean joints—lateral view . . . . .	274
157. „ „ posterior view . . . . .	275
158. „ „ showing the deep sesamoid ligaments . . . . .	<i>ib.</i>
159. Diagram of the deep sesamoid ligaments . . . . .	276
160. „ of suspensory, inferior sesamoid and navicular ligaments . . . . .	278
161. Posterior view of the right fore digit, showing the ligaments and tendons . . . . .	280



FIG.	PAGE.
162. Coffin joint—lateral view . . . . .	283
163. Lower articulating surfaces of the coffin joint . . . . .	<i>ib.</i>
164. Inferior aspect of the pelvis, showing its joints . . . . .	286
165. Lateral view of the pelvis, with the sacro-sciatic ligament . . . . .	<i>ib.</i>
166. Hip joint . . . . .	288
167. Posterior view of the femoro-tibial joint . . . . .	290
168. Femoro-tibial joint—lateral view, with condyle removed . . . . .	<i>ib.</i>
169. Semilunar cartilages of the stifle . . . . .	291
170. Stifle joint—internal aspect . . . . .	292
171. Internal view of the hock joint . . . . .	296
172. Postero-internal view of the same . . . . .	297
173. Antero-external view of the same . . . . .	<i>ib.</i>
174. Internal aspect of the hock, showing the deep ligaments . . . . .	298
175. External view of the same, showing the deep ligaments . . . . .	<i>ib.</i>
176. Index to the Engraving of the Muscles . . . . .	305
177. Primitive bundle of striated muscular fibre . . . . .	308
178. Muscular fibre breaking up transversely into discs . . . . .	<i>ib.</i>
179. Drawing of two muscular fibres terminating in a tendon . . . . .	311
180. Fragment of an elementary muscular fibre held together by the untorn but twisted sarcolemma . . . . .	<i>ib.</i>
181. Distribution of blood-vessels in muscular tissue . . . . .	312
182. Looped termination of a nerve in muscular tissue . . . . .	313
183. Panniculus carnosus . . . . .	317
184. Muscles of the trunk—deep layer . . . . .	324
185. Muscles of the sublumbar region and inner side of the thigh . . . . .	336
186. Antero-lateral view of body—superficial muscles . . . . .	348
187. Diaphragm . . . . .	361
188. Drawing of the head, showing the muscles in the intermaxillary space . . . . .	373
189. Muscles of the eyeball . . . . .	385
190. View of the muscles on the outer side of the fore-limb . . . . .	388
191. Muscles on the inner side of fore-limb . . . . .	392
192. Muscles surrounding the humerus—deep layer . . . . .	395
193. Posterior view of the superficial muscles of the hind-limb . . . . .	417
194. Inner side of hind-limb, with the superficial muscles removed . . . . .	427
195. Muscular fibre, referred to by Dr Martin, pages 309, 310 . . . . .	454
196. Deep muscles of the neck . . . . .	<i>ib.</i>

## ARTICULATIONS.

---

THE bones of the skeleton are connected together by various means, and at different points of their surfaces, so as to form what are designated *joints* or *articulations*. In certain joints, as in those of the sacrum, and nearly all those of the head, the bones are placed in close contact, the adjacent margins being separated only by a thin layer of fibrous membrane, called the sutural ligament, or, in the case of the bodies of the vertebræ, sacral and cephalic, by a thin layer of cartilage. In other joints, as between the bodies of the vertebræ, in which a limited motion is allowed, the union is effected by the interposition of fibro-cartilage, by which the whole articular surfaces are firmly, though not immoveably, bound together. In joints endowed with free motion, the articular extremities of the bones are generally expanded, and covered with cartilage of encrustation; they are provided in some cases with fibro-cartilage, held together by strong bands of fibrous membrane, called ligament, and lined by a delicate membrane, the synovial, which secretes synovia to lubricate the joint and facilitate its motions. The parts, accordingly, which enter into the formation of a joint are: bone, cartilage, fibro-cartilage, ligament, and synovial membrane.

Modes of union among bones.

Sutural ligament.

Discs of fibro-cartilage.

Constituents of moveable joints.

Summary of the parts composing a joint.

*Bone* is the fundamental element in all joints. Flat bones articulate by their margins, short bones by various parts of their surface, and long bones by their enlarged and spongy extremities. The articulating surfaces of adult bones are covered by a thin compact layer (articular lamella), which differs from ordinary bone in containing no Haversian canals, and in having a cartilaginous, and

Bone.

Articular lamella.

not a fibrous basis, when the earthy matters have been removed by acids. This lamella, which is necessarily the most compact part of all bones, is in reality an ossification of the articular cartilage. It contains no blood-vessels; these, on approaching its internal surface, form loops turning back in the cancellous tissue. The evident use of this is to give more firmness and solidity to the articulating surfaces, and to afford a smooth means of attachment for the encrusting cartilage.

Cartilage of  
encrusta-  
tion.

The *articular cartilage* forms a thin encrustation on the diarthrodial aspects of the bones, where, by its rebounding property, it breaks the violence of concussions, and by the smoothness of its free surface, greatly facilitates the gliding of one bone upon the other. On the rounded ends of bones which sustain great pressure, the cartilage is found thickest in the centre, and decreases in depth toward its circumference; in the cotyloid cavities, on the contrary, it is thickest at the circumference, diminishing gradually toward the centre. It is extravascular, perfectly insensible, and contains no lymphatics.

Fibro-carti-  
lages of  
three kinds.  
Inter-arti-  
cular;

The *fibro-cartilages* of joints are of three kinds—the inter-articular, the connecting, and the circumferential. The inter-articular fibro-cartilages are flattened biconcave plates, of an oval, round, or semilunar form, interposed between the bones in such diarthrodial articulations, as are subjected to severe shocks or frequent movements. They serve to deaden the shocks, to ensure perfect adaptation when this is not provided for by the form of the bony surfaces, and to give solidity and firmness to the joint by preserving more of the articulating surfaces in contact. The connecting fibro-cartilages are discs, composed of numerous laminae uniting the ends of the bones, as will be noticed in describing the vertebral articulations. The circumferential fibro-cartilages consist of rims or masses of fibro-cartilage, either encircling a cotyloid cavity, as in the acetabulum, or attached to one side of it, as behind the glenoid cavities of the os coronæ. These structures deepen the cavities to which they are attached, extend the articular surfaces, and break the force of concussion.

connecting;

and circum-  
ferential.

Ligaments,  
white and  
yellow.

The *ligaments* are either of white or yellow fibrous tissue, the former being found in those situations in which great firmness is required—the latter, when a constant weight has to be sustained, as in the support of the head by the ligamentum nuchæ.

Synovial  
membranes.

The *synovial membranes* are thin delicate tubular membranes attached by their free ends round the articular surfaces, the movements of which they facilitate by their glairy secretion.



They are allied in structure and function to serous membranes, being composed of bundles of white and yellow fibres interwoven, and forming a tough elastic membrane, or, in fact, a dense layer of areolar tissue, covered by stratified scaly epithelium, which renders its inner surface smooth and shining.

Joints, endowed with great mobility, are provided with a capsular <sup>Articular synovial membranes.</sup> and other ligaments, which are lined by synovial membrane. In foetal life, the articular cartilages are found also thus covered, so that perfect sacs are formed at this period by the structures under consideration. After birth the membrane gives way on the surface of the cartilage, and is absorbed, except around the ends of the bones, and lining the ligaments. Here it is always found of a pinkish colour, possessed of considerable vascularity, having at its extreme edge a network of blood-vessels immediately surrounding each articular surface, and which constitutes a zone termed "circulus articuli arteriosus."

We cannot refer to the prominences in synovial sacs more tersely <sup>Folds and fringes.</sup> than in the admirable work by Quain and Sharpey:—

"In several of the joints, folds of the synovial membrane, often containing more or less fat, pass across the cavity; these have been called synovial or mucous ligaments. Other processes of the membrane simply project into the cavity at various points. These are very generally cleft into fringes at their free border, upon which their blood-vessels, which are numerous, are densely distributed. They often contain fat, and then, when of tolerable size, are sufficiently obvious; but many of them are very small and inconspicuous. The fringed vascular folds of the synovial membrane were described, by Dr Clopton Havers (1691), under the name of the *mucilaginous glands*, and he regarded them as an apparatus for secreting synovia. Subsequent anatomists, while admitting that, as so many extensions of the secreting membrane, these folds must contribute to increase the secretion, have, for the most part, denied them the special character of glands, considering them rather in the light of a mechanical provision for occupying spaces which would otherwise be left void in the motion of the joints. Havers' view has, however, been revived by Mr Rainey,\* who finds that the processes in question exist in the bursal and vaginal synovial membranes as well as in those of joints, wherever, in short, synovia is secreted. He states that their blood-vessels have a peculiar convoluted arrangement, differing from that of the vessels of fat, and that the epithelium covering them, 'besides inclosing separately each packet of convoluted vessels, sends off from each tubular sheath secondary processes of various shapes, into which no blood-vessels enter.' Kölliker, who has since taken up the inquiry, also finds that fringed membranes exist in all joints and synovial sheaths, as well as in most synovial bursæ, and that they consist of vascular tufts of the synovial membrane, covered by epithelium, and now and then containing

\* Proceedings of the Royal Society, May 7th, 1846.



fat-cells, and more rarely isolated cartilage-cells. He also observed the curious 'non-vascular secondary processes,' described by Mr Rainey, the larger of which, he says, consists of fibres of areolar tissue in the centre, sometimes containing cartilage-cells, and a covering of irregularly thickened epithelium."

Synovial  
bursæ.

In different situations, beneath the skin, over prominences such as the shoulder and hip-joints, the areolar tissue forms imperfect sacs lubricated by an abundant secretion. In deeper parts, such as in the angle between the os calcis and tibia (Fig. 137), or in the angle of bifurcation of the suspensory ligament, behind the metacarpal or metatarsal bones, closed sacs are formed of condensed areolar tissue, precisely like the synovial membrane lining a joint. Many of the subcutaneous bursæ differ from the more perfect and deeper ones, and are distinguished by the absence of scaly epithelium.

Synovial  
theceæ.



Fig. 137.—A morbid specimen, in which are shown the enlarged synovial bursæ, 1, between the tibia, 3, and os calcis, 4. Also a synovial sheath, enlarged as the result of disease, and situated in the space between and behind the metatarsal bones, large, 7, and small, 6.

In several parts of the body osseous grooves are formed as behind the metacarpal and metatarsal bones, in which tendons glide, and are provided with synovial sheaths, to facilitate movement. One layer of the synovial membrane, in such a situation, covers the tendon, and the other is reflected on the sides of a canal or groove, in which the tendon is found. The parietal and reflected parts are thus connected by folds or 'fræna.'

Synovia.

The secretion constantly formed within joints is essential to their free movement, and that it is abundant may be proved by the amount discharged in a case of open joint, especially when the injured articulation is permitted freedom of motion. Indeed, action seems to be the chief stimulus to the secretion, and, if a joint is placed at rest by a starched bandage or the use of splints, the amount of synovia secreted becomes at once considerably less. The characters of synovia are somewhat different when secreted in a joint at rest or in motion. Thus Frerichs found in 1000 parts of synovia—

	In a Stall-fed Ox.	In an Ox that had been working all day.
Water, . . . . .	969·90	948·54
Solid matter, . . . . .	30·10	51·46
Mucus, with epithelium, . . . . .	2·40	5·60
Fat, . . . . .	0·62	0·76
Albumen and extractive matter, . . . . .	15·76	35·12
Salts, . . . . .	11·32	9·98

The joints are divided into three classes: the immoveable, the mixed, and the moveable, the first and last classes being capable of further subdivision. Division  
of joints.

#### IMMOVEABLE ARTICULATIONS—SYNARTHROSIS.

The *immoveable articulations* or *synarthrosis* (σύν, with; ἄρθρον, Fixed joints, where found. a joint), are found wherever broad flat bones unite to form cavities for the protection of important organs, as in the chief articulations of the pelvis and head. This variety has three forms: suture, schindylesis, and gomphosis. Forms.

*Sutures* (sutura, a seam), are true or false: 1st. True suture is where the margins are connected by a series of processes or indentations wedged into each other. When the processes are tooth-shaped, they are called *sutura dentata* (dens, a tooth); when like the teeth of a saw, they are called *sutura serrata* (serra, a saw); when considerably bevelled as well as serrated, they are called *sutura limbosa* (limbus, a selvage.) 2nd. False suture is that in which rough surfaces are placed in apposition to one another without connexion by teeth. When this is from the overlapping of two bones by large bevelled margins, as in the temporo-parietal, it is called *sutura squamosa* (squama, a scale); when from simple apposition of two contiguous surfaces, as in the occipito-temporal, it is called *sutura harmonia* (ἄρειν, to adapt.) True suture.  
False suture.  
S. squamosa.  
S. harmonia.

*Schindylesis* (σχινδύλησις, a fissure) is when the sharp lamina of one bone is morticed between two laminae of another, as in the union of the anterior ala of the sphenoid with the frontal, or the superior maxillary with the nasal bones. Schindylesis,  
in sphenofrontal joint.

*Gomphosis* (γόμφος, a nail) is that form of articulation in which a conical mass is fixed in a socket, like a nail in a board, and is best illustrated by the implantation of the teeth in the alveoli of the maxillary bones. Gomphosis,  
where teeth  
are fixed in  
a socket.

## MIXED ARTICULATIONS—AMPHIARTHROSIS—SYMPHYSIS.

Mixed  
joints;  
their mode  
of union.

*Amphiarthrosis* (*αμφι*, on all sides; *ἄρθρον*, a joint), or *symphysis*, includes those joints in which smooth, and even rough and indented surfaces are connected together at all parts by interposed fibro-cartilaginous discs, as in the union of the bodies of the vertebræ; also such as are covered by fibro-cartilage, lined to a small extent by synovial membrane, as in the sacro-iliac articulation. Both these varieties are commonly provided with external ligaments. The first resembles the synarthrodial joints by the continuity of the surfaces and the absence of a synovial membrane; the last, the diarthrodial, by the converse of these characters. When the external ligaments are wanting, the former class is only distinguishable from synarthrosis by the greater freedom of motion.

## MOVEABLE ARTICULATIONS.—DIARTHROSIS.

Structure of  
moveable  
joints.

Divisible  
into four  
varieties.

Gliding  
joints.

Ball-and-  
socket  
joints,

their move-  
ments.

In *diarthrosis* (*δια*, through; *ἄρθρον*, a joint), or *moveable joints*, two contiguous bony surfaces are encrusted with cartilage, retained in contact by ligaments, and surrounded by synovial membrane. Their connection is further strengthened by surrounding muscles, as is well seen in shoulder-slip, when, from sprain of the muscles occupying the dorsum scapulæ, these are thrown out of use, and the head of the humerus rolls outward at every step. The moveable joints are divisible into four varieties, according to the motions they respectively possess, and are designated: *arthrodia*, or *gliding joints*; *enarthrosis*, or *ball-and-socket joints*; *ginglymus*, or *hinge joints*; and *diarthrosis rotatorius*, or *pivot joints*. *Arthrodia* (*ἄρθρον*, a joint; *αῶ*, to adapt) is that form of joint in which a slight gliding motion only is allowed. It is formed by the apposition of plain surfaces, or of one slightly convex and the other correspondingly concave, their movements on each other being limited by surrounding ligaments or osseous prominences. The best examples of this joint are found between the articulating processes of the vertebræ and between the bones composing the two rows of the carpus and tarsus. *Enarthrosis* (*εν*, in; *ἄρθρον*, a joint), or the *ball-and-socket joint*, is formed by the reception of a globular head in a cup-shaped cavity, the parts being connected by capsular and other ligaments, and strengthened in most cases by enveloping tendons. This joint is possessed of the most varied movements, flexion, extension, adduction, abduction, circumduction, and rotation, are all performed within certain limits. We have examples of this



in the shoulder and hip. *Ginglymus* (γυγγλυμος, a hinge), or *hinge joint*, is that variety in which the articular surfaces are so fixed to each other by their form and ligamentous connections, that the movements are confined to those of flexion and extension, which are performed with the precision of a hinge. The best example of this joint is the tibio-tarsal articulation. In the *diarthrosis rotatorius* (rotatus, turned), *lateral ginglymus*, or *pivot joint*, a rounded part of one bone, turns in a ring formed partly by the other bone, but completed by ligament. The movement of such joints is that of rotation only. The best examples are found in the axo-oid-atloidean articulation, and in the superior radio-ulnar joint of carnivora.

Hinge joints.

Movements.

Lateral hinge joints.

Motions.

## KINDS OF MOVEMENT ADMITTED IN JOINTS.

The varieties of movement allowed in joints depend on the form of the articulating surfaces, and the firmness and arrangement of the ligaments. They may be divided into four kinds: *gliding*, *angular movement*, *circumduction*, and *rotation*.

Mobility depends on surfaces and means of union.

Varieties.

*Gliding* is the simplest of all movements, since the one surface simply glides to a limited extent upon the other. It is common to all moveable joints, limited, however, by the ligamentous connection. Some joints, moreover, such as the arthrodial, possess no other movement.

Gliding.

*Angular movement* occurs only between long bones. It is of four kinds: *flexion*, *extension*, *adduction*, and *abduction*. The two first consist in a movement of the bones forwards or backwards, so as to close or open the angle formed by the two bony rays; the two latter consist, respectively, in turning the lower ray inward towards the body, or outwards from the body, forming in either case an angle, the magnitude of which varies with the extent of the movement. In some joints, as in the tibio-tarsal, flexion and extension alone are permitted, so that these are true hinge joints. In others, as in the hip and shoulder, adduction and abduction are superadded, but this is only met with to any extent in the most mobile joints, the action of which belongs to the next category.

Angular movement,

how accomplished.

*Circumduction* can only take place freely in ball-and-socket joints. In this movement the head of the bone moves in the cavity in such a manner that all the different angular motions are successively induced, the limb meanwhile circumscribing a conical space, the base of which corresponds to the distal end of the member, the apex to the articulation. The shoulder and hip joints best exemplify this.

Circumduction, its mechanism.



Rotation.

*Rotation* differs from circumduction in this, that the bone simply rotates on its own axis, without altering its position relatively to the other bones. It may be effected by one bone rotating on a pivot-like process of another, as in the case of the atlas on the axis; by one rotating in an osseo-fibrous ring, as of the radius in its superior articulation with the ulna in carnivora; or by the rotation of a spherical head in a cavity, as in the hip joint.

Modes of rotation.

Limited motion in limbs of animals.

In the extremities of our domestic quadrupeds the movements of rotation and circumduction are much more limited than in the human subject, or the quadrumana, the principal movements, indeed, are those of flexion and extension. The reason of this is obvious, the limbs are employed as locomotive rather than prehensile organs, and to fulfil this purpose the greatest amount of solidity is required, a condition incompatible with great freedom of motion. Mobility has, accordingly, given place to strength, and we have free flexion and extension with very limited adduction, abduction, and rotation. The fore limbs of carnivora have considerable mobility, are capable, moreover, of performing pronation and supination, in accordance with the habits of these animals, which demand for those organs a certain prehensile power. These movements, however, though similar in kind, are much more limited than in the human subject.

In describing the joints, the same order is adopted as in the description of the bones, those of the vertebræ being first noticed, then those of the head, followed by those of the thorax and extremities.

## ARTICULATIONS OF THE SPINE OR VERTEBRAL COLUMN.

Division of vertebral joints.

The joints of the vertebral column are of two kinds: 1st. The articulations of the *vertebræ* with *one another*—*intervertebral*. 2nd. Articulations of the *vertebræ* with the *head, ribs, and pelvis*.

### I. INTERVERTEBRAL ARTICULATIONS.

Articulating parts. Bodies: their articulating surfaces.

The vertebræ are connected with each other by their bodies and rings. The *bodies* join each other by their anterior and posterior aspects. In the cervical region the anterior surface is represented by a true head, the posterior surface by a cotyloid cavity, for the reception of the head of the next vertebra. From the first dorsal vertebra to the sacrum, these surfaces become gradually more and more flattened, though they invariably preserve their distinctive forms as far as the last-named region. They are connected by *intervertebral*

Their means of union.

*fibro-cartilage*, and two strong ligamentous bands, called the *superior* and *inferior common ligaments*.

(a). The *intervertebral fibro-cartilage*, or *intervertebral substance*, Intervertebral substance; (Lig. intervertebralia) is a plate or disc of fibro-cartilage, placed between the bodies of each pair of vertebræ, commencing at the cotyloid cavity of the axis, and terminating with the anterior aspect of the sacrum, They are convex anteriorly, and concave posteriorly; or, in other words, its concavo-convex form they correspond in shape to those parts of the vertebræ between which they are interposed.

The discs are covered superiorly and inferiorly by the common ligaments, which are intimately adherent to them; in the dorsal region they are further connected laterally by short ligaments to the heads of all the ribs. its relations;

The intervertebral substance is composed of an external or laminar part, forming its circumference, and a soft or pulpy part, which occupies the centre. The disc is chiefly made up of the first of these, Laminae. the plates of which are formed of fibrous tissue and fibro-cartilage, one being composed of the former, and the next of the latter. The plates are arranged concentrically within each other, having their edges resting upon and inserted into the surfaces of the two bones they bind together; they do not, however, extend in a straight direction between these surfaces, but those near the circumference are bent in an outward, and those internally in an inward direction. These bends have their curvature increased by the inclination of the spine to that side on which they are situated; those on the opposite side being at the same time straightened. The central part of the intervertebral disc is a pulpy and elastic mass, which is naturally compressed between the bones and laminar portion, and bulges out considerably on a Central pulpy portion. section being made. (Fig. 139).

The thickness of the fibro-cartilage is greatest in the cervical and lumbar regions.

The *superior common ligament* (Lig. longitudinale posterius) is situated on the superior aspect of the bodies of the vertebræ, extending from the axis to the sacrum. It is smooth and shining on its superior surface, which forms the floor of the spinal canal, and on which lies the envelope of the spinal marrow (*dura mater*). It is broader over the intervertebral discs than on the bodies of the vertebræ, so that its margin presents a series of angles, with intervening concave spaces. By its inferior surface it takes insertion upon the intervertebral fibro-cartilages, and on the triangular spaces on the upper aspect of the Superior common ligament; its form; its insertions.

bodies; but from the median part of these last it is separated by the transverse branch of a large venous plexus, found on each side of the ligament.

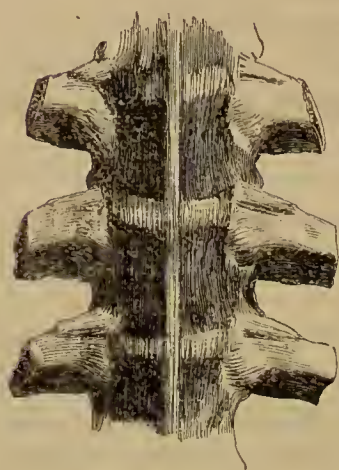


Fig. 138.



Fig. 139.



Fig. 140.

Fig. 138. Vetebræ, showing the inferior common ligament.

Fig. 139. Intervertebral substance on coccygeal vertebra.

Fig. 140. Superior common ligament.

Inferior  
common  
ligament:  
where  
placed.

Form.

Insertion.

Union of the  
vertebral  
rings.

Ligaments  
of the  
rings.

Capsular  
ligaments.

The *inferior common ligament* (Lig. longitudinale anterius) placed upon the inferior part of the spine, extends from the sacrum forward upon the lumbar and posterior two-thirds of the dorsal region. From the eighth dorsal vertebra forward, it is replaced by the longus colli muscle. It begins anteriorly by a narrow band, which gradually increases in breadth and strength as far as the sacrum, upon the inferior surface of which it is expanded. The superior aspect of this ligament becomes inserted into the inferior spines of the vertebræ, and upon the intervertebral substance; its inferior surface lies in contact with the posterior aorta.

The *rings* of the vertebræ are connected together by their anterior and posterior articulating processes, for the description of which the reader is referred to the OSTEOLOGY.

The means of union are:—(a), capsular; (b), supra-spinous; (c) interspinous; and (d), interlamellar ligaments.

The *capsular ligaments*, (Lig. articularia processum obliquorum), one for each joint of the articulating processes, are fibrous expansions



surrounding the diarthrodial facets, and each bearing on its internal aspect the synovial membrane proper to its individual joint. These capsules are formed of *yellow elastic tissue*, in the cervical region, where they are greatly developed, to correspond to the enormous articulating processes. In the dorsal region they are composed of *white fibres*, which are very thinly spread over the outside of the diarthrodial facets.

Structure in cervical,

and in dorsal regions.

The *supra-spinous ligament* extends along the summits of the spinous processes of the vertebræ from the sacrum to the occiput. It may be divided into two portions: a *posterior*, or *dorso-lumbar*, and an *anterior*, or *cervical*, the latter being that described by authors as the *ligamentum nuchæ*.

Supra-spinous ligament. Position. Dorso-lumbar and cervical parts.

The *dorso-lumbar* portion is a strong cord, composed of white fibrous tissue. It originates from the sacral spine, and extends forward to the anterior third of the dorsal region, where it assumes the characters of, and becomes continuous with, the cervical ligament. It takes its insertion upon the superior spines of all the lumbar, and of the ten or twelve last dorsal vertebræ.

Dorso-lumbar formed of white fibres;

its connections.

At its sacral insertion it becomes confounded with the superior ilio-sacral ligaments, while anteriorly it is equally intimately connected to the common fascia of the dorsal and lumbar regions.

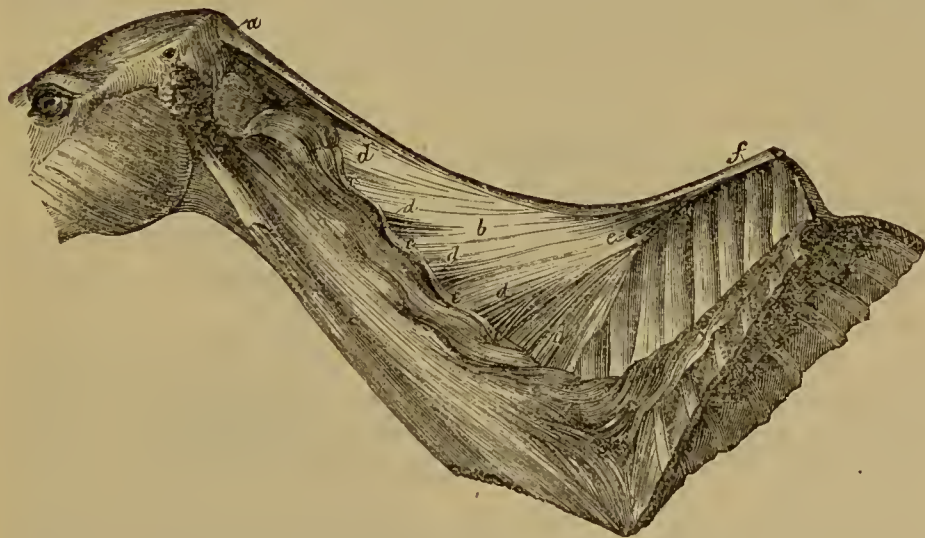


Fig. 141.—(LEYH).—*a*, The upper part of the funicular portion of the ligamentum nuchæ; *b*, The left membranous layer indicating the direction of the elastic fibres; *c c*, Interspinous ligaments of the cervical vertebræ; *d d*, Spaces between the insertions of the ligamentum nuchæ, and containing areolar and elastic tissues; *e*, Opening in the ligamentum nuchæ above the spines of the first and second dorsal vertebræ; *f*, Posterior attachment of the ligamentum nuchæ continuous with the supra-spinous ligament.



Cervical part  
of yellow  
tissue.

The *cervical portion*, or *ligamentum nuchæ*, is composed of yellow elastic tissue, constituting an elastic apparatus, which separates the cervical muscles of the right side from those of the left, and maintains the head in its natural position with little assistance from the muscles, consequently without inducing fatigue.

It is divisible into a funicular and a lamellar portion.

Cord-like  
portion.

The *funicular portion* is a strong cord, inserted posteriorly upon the dorsal spines, from the fourth to the seventh, and anteriorly into the cervical tuberosity of the occipital bone. Superiorly, it is divided into two by a median groove, and covered by adipose tissue; laterally, it gives insertion to many of the cervical muscles, and from its inferior surface originate most of the fibres of the lamellar division.

Laminated  
part.  
Insertions  
of the lamel-  
lar part.

The *lamellar part* consists of two flattened lamellæ, placed side by side. Each extends from the spinous process of the first four dorsal vertebræ, and from the inferior aspect of the funicular part downward and forward to the last six cervical vertebræ; it gets inserted upon the cervical spines by six bundles, which become confounded with the interspinous ligaments of the neck. In the two posterior bundles, the fibres are few and scattered, but interlace by anastomosing fibres with the bundles adjacent. The whole are maintained in their places by areolar tissue.

Relations.

Each lamella has its internal surface separated from its fellow by areolar tissue, while by its outer aspect it is related to the anterior portion of the longissimus dorsi and the complexus major.

Interspinous  
ligament  
insertions.

The *interspinous ligaments* (Lig. interspinosum) fill up the *interspinous spaces*, and become inserted on the anterior and posterior borders of the spinous processes. They are continuous above with the supra-spinous, and below with the inter-lamellar ligaments.

Structure,

Each is composed of two lateral folds applied against each other, as in the lamellæ of the cervical ligament. Their external surface is in relation to the semispinalis dorsi et lumborum.

in dorso-  
lumbar,

In the dorsal and lumbar regions these ligaments are essentially composed of white fibrous tissue, the fibres of which are directed from before backwards and downwards. Interposed between the lamellæ there is a thin layer of yellow elastic tissue, the fibres of which proceed in an opposite direction to the last, viz., from behind forwards and downwards; this layer is thickest in the anterior part of the

and in cervi-  
cal regions.

Inter-lamel-  
lar liga-  
ments.

dorsal region. In the cervical region the yellow elastic layer is alone found.

The *interlamellar ligaments*, or *ligamenta subflava*, placed between

the laminae of the vertebrae, are each formed of two lateral halves, which seem individually to be prolongations of the interlamellar fold of that side to which they belong. Externally they become confounded with the capsular ligaments of the articulating processes. Their anterior borders are inserted into the posterior margin of the lamina in front; their posterior border is attached to the anterior border of the lamina behind. Related superiorly to some of the spinal muscles, they are applied internally against the dura mater. Like the interlamellar, they are composed of yellow elastic tissue in the cervical, and of white fibres in the dorso-lumbar regions.

Insertions.

Relations.

Structure.

#### JOINTS IN THE ANTERIOR REGION OF THE VERTEBRAL COLUMN.

The articulation between the two first cervical vertebrae, and that between the atlas and the head, differ sufficiently from those of the vertebrae generally to warrant their description being left off until these had been disposed of.

Anterior joints of the vertebral column.

#### AXOIDO-ATLOIDEAN ARTICULATION.

The articulation between the atlas and the axis forms the type of a pivot joint. The articulating surfaces consist: on the part of the axis, of the odontoid process, and two slightly convex diarthrodial surfaces on each side of the base of that process; on the part of the atlas, of (a), a semi-cylindrical concavity, grooved out on the upper surface of the body, and (b), two lateral facets on the transverse processes, one on each side of the vertebral foramen.

Articulation of the two first cervical vertebrae is a lateral hinge joint. Articulating surfaces.

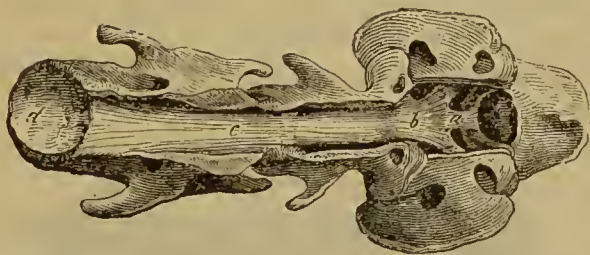


Fig. 142.—(LEYH.)—a, The inferior ligament of the occipito-atloidean joint or extension of the superior common ligament; b, The odontoid ligament; c, Commencement of the upper common ligament of the vertebrae; d, Articular cavity, with fibro-cartilage, of the third cervical vertebra.

It is bound together by four ligaments, namely: 1st, the *odontoid*; 2nd, the *inferior axoido-atloid*; 3rd, the *superior axoido-atloid*; and 4th, the *capsular*.

Means of union.

The *odontoid ligament* (Lig. suspensorium processus odontoides) Odontoid ligament.

which is simply a continuation of the superior common, is very short and powerful, flattened from above downwards, and triangular with its base turned towards the atlas. It is composed of white fibres, which are inserted posteriorly upon the superior grooved surface of the odontoid process, and anteriorly upon the transverse ridge which divides into two portions the inner or concave aspect of the inferior arch of the atlas; some fibres are inserted on asperities in front of that ridge, others run forward to gain an insertion upon the occipital condyles. On the lower aspect of this ligament is the synovial membrane of the joint, superiorly it is in contact with the dura mater.

Insertions.

Relations.

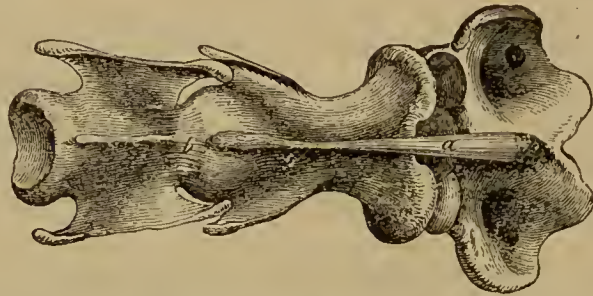


Fig. 143.—(LEYN.)—*a*, Inferior ligament of the odontoid process; *b*, Intervertebral disc.

Inferior  
axoido-at-  
loid liga-  
ment.  
Form and  
insertion.  
Relations.

The *inferior axoido-atloid ligament* (Lig. processus odontoidi inferius) is a broad, thin, and triangular band, originating posteriorly from the middle of the inferior aspect of the axis, and becoming inserted anteriorly on the tubercle below the ring of the atlas. It is covered inferiorly by the longus colli, and has on its superior aspect the synovial membrane of the joint. Laterally it is continuous with the *fibrous capsule* of the articulation.

Superior  
axoido-at-  
loid liga-  
ment.

The *superior axoido-atloid ligament* represents in every respect

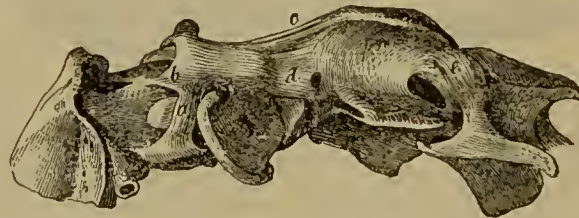


Fig. 144.—(LEYN.)—*a*, The lateral ligament of the occipito-atloidean joint; *b*, The upper ligament of the same; *c*, The upper ligament of the axoido-atloidean joint; *d*, The capsular ligament of the same; *e*, The capsular ligament of the oblique processes.

the interspinous ligaments of the other cervical joints. It is composed of two lamellæ of yellow elastic tissue, which, together, form



a narrow triangle, the base of which is turned forward. It becomes confounded laterally with the capsular ligament.

The *capsular ligament* (Lig. intercervicale) becomes continuous above and below with the superior and inferior ligaments of this articulation. It may almost be said to take its insertion all round the posterior border of the atlas and the anterior of the axis. It is related externally to the obliquus capitis inferior; internally it is in contact with the *dura mater*; it sends some fibres to the odontoid ligament.

The *synovial membrane* is related to the odontoid and inferior ligaments of the joint, together with the articular part of the capsular.

Rotation is the only movement of which this joint is capable. The axis being fixed, the atlas turns round the odontoid process under the influence of muscular action.

*Differences.*—In the *pig* and *carnivora* the *odontoid ligament* is represented by two bands, which, originating from the summit of the odontoid process, become inserted upon the inner margin of the occipital condyles. These animals possess, in addition, a transverse ligament, which gains insertion upon both sides of the inferior arch of the atlas, thus crossing the odontoid process superiorly, and maintaining it in the groove of the atlas. Between the transverse ligament and the odontoid process is a small synovial capsule to facilitate gliding. The synovial membrane of the joint always communicates anteriorly with that of the occipito-atloid articulation.

#### OCCIPITO-ATLOID ARTICULATION.

The *articulation of the atlas with the occiput* is a condyloid or double arthrodial joint. The articular surfaces are: on the part of the atlas two concave diarthrodial surfaces that replace the articulating processes and the head of the vertebræ; on the side of the occiput two condyles, one on each side of the foramen magnum.

The *capsular* (Lig. articularia capitis) may be said to be the only ligament of this joint. It is inserted round the condyles of the occiput and the whole anterior circumference of the atlas. The capsule is thin inferiorly, but becomes strengthened above by four bundles of white fibres; two of these, the superior (Lig. obturatorium posterius cervicis) intersect each other in the form of the letter X; the remaining two, the lateral (Lig. lateralia atlantis) extend from the atlas forwards and downwards to the roots of the styloid processes.



- Relations.** This ligament bears on its inner aspect the synovial membranes of the articulations, while externally it is covered by a number of muscles, which protect the articulation, and prove very efficient ligaments. The chief of these are on each side the rectus capitis, the obliquus minor, and the complexus major. The funicular portion of the cervical ligament and some fibres of the odontoid ligament (Lig. obturatorium anterius cervicis) likewise aid in the retention of this joint.
- Muscles which support the joint.**
- Synovial membranes.** The joint is provided with two synovial membranes, one for each condyle and atlantal cavity; these are supported externally by the capsular ligament; internally by the dura mater and some fibres prolonged from the odontoid ligament to the condyles.
- Movements.** The principal movements of this joint are *flexion* and *extension*, to which may be added *slight lateral inclination* and *circumduction*.
- Pig and carnivora have two bands from the axis; only one synovial membrane.** *Differences.*—In the *carnivora* and in the *pig* this joint possesses, beside the capsular ligament, two odonto-occipital bands previously mentioned. It has only one synovial membrane for both condyles.

#### CHARACTERS OF SOME PECULIAR INTERVERTEBRAL ARTICULATIONS.

- Sacro-coccygeal and coccygeal joints,**  
**articulate by their bodies only.**  
**Fibro-cartilages are bi-concave.**  
**Inter-sacral joints.**  
**Sacro-lumbar joints. Thick intervertebral disc.**  
**Sacro-transverse joints**
- 1st.** The *intercoccygeal* and *sacro-coccygeal articulations*, while preserving the general arrangement of other joints of the vertebræ, are considerably modified in accordance with the rudimentary state of the vertebræ composing this region. The vertebræ of the tail articulate by their bodies only, their annular parts being either entirely absent, or existing only in the most rudimentary condition. Both the anterior and the posterior aspects of the bone being convex, the interarticular fibro-cartilages are necessarily bi-concave. The ligaments by which the bones are connected are made up of longitudinal bundles, which spread themselves over the surface of the bones so as to envelope them, as it were, in a common fibrous sheath.
- 2nd.** *Sacral articulations.*—The vertebral segments composing the sacrum are ankylosed into a single bone. The supra-spinous ligament is, however, continued along its spine, and true interspinous ligaments exist between the processes of which that is composed.
- 3rd.** Between the *last lumbar vertebra and the sacrum*, all the common characters of other intervertebral articulations are met with. The interarticular fibro-cartilage is very thick. Moreover, the last lumbar vertebra has two oval and slightly rounded diarthrodial facets on the posterior border of its transverse processes, which correspond to similar facets on the base of the sacrum. These articulations (sacro-transverse) are bound together by capsular ligaments (Lig.

capsular sacro-lumbale), which surround the joints and support on their inner surface the synovial membrane.

have capsular ligaments.

4th. Between the transverse processes of the two last lumbar vertebræ, a similar disposition is met with, and similar ligaments (Lig. articularia processuum transversorum) exist.

Joints between lumbar transverse processes.

These diarthrodial joints on the transverse processes of the lumbar region are only met with in solipedes.

*Differences.*—In the *ox* the intervertebral discs are much thicker than in the horse. The inferior common ligament is of great strength in the lumbar region. The supra-spinous ligament is formed of yellow fibres throughout its whole extent. The cervical portion (ligamentum nuchæ) is of great strength, the weight of the head being much greater than in solipedes. The funicular part only attaches three bundles of the lamella on either side; these are inserted on the spinous processes of the second, third, and fourth cervical vertebræ, while a second part, originating from the anterior border of the first dorsal spine, takes its insertion by four bundles on the spinous processes of the four last cervical vertebræ.

Ligaments of the spine in the ox.

Thick intervertebral discs.

Yellow supra-spinous ligament.

Cervical part strong.

In the *pig* no proper cervical ligament exists, its short and comparatively immovable neck being supported by muscles only. There may, however, be noticed a superficial fibrous raphe extending from the first dorsal spine as far as the occiput.

No true cervical ligament in the pig.

The *cat*, like the *pig*, has only a raphe substituting the cervical ligament. In the *dog*, a small cord extends from the dorsal spines to gain the spine of the axis. In the whole vertebral column of the *cat*, and in the cervical region of the *dog*, the interspinous ligaments are replaced by muscular bundles. In the first coccygeal all the characters of a perfect vertebral joint are met with.

Same ligament is rudimentary in carnivora.

In cat and dog muscles replace the interspinous ligaments.

#### ARTICULATIONS BETWEEN THE BONES OF THE HEAD.

The only joints which in this region claim our attention are those between the lower jaw and the cranium (temporo-maxillary), those between the cranium and the cornua of the os hyoides (temporo-hyoid) and those between the pieces of the hyoid bone (interhyoid). The fixed joints may be studied in the OSTEOLOGY.

#### TEMPORO-MAXILLARY JOINTS.

The lower jaw articulates with the temporal bone on each side by its corresponding condyle.

The articulating surfaces are: on the part of the temporal bone, the

Articulating surfaces.

glenoid cavity and the temporal condyle which exist at the base of the zygomatic process; the glenoid cavity has no cartilage of incrustation, but is covered by synovial membrane: on the side of the lower jaw there is a transversely oblong condyle covered by articular cartilage.

Interarticular  
fibro-cartilage.

Such surfaces, it is evident, are not well adapted to each other; perfect co-adaptation is accordingly secured by the intervention of a fibro-cartilaginous disc (*cartilago interarticularis*). This disc is flattened from above downwards, and thickest anteriorly. It is concave on the anterior part of its upper aspect, corresponding to the temporal condyle, and convex in its posterior part, where it fits into the glenoid cavity; the inferior surface is concave throughout, for the reception of the condyle of the lower jaw.

Capsular  
ligament.

The joint is possessed of only one ligament, the *capsular* (*Lig. capsulare articuli maxillaris*). This is formed of an expansion of yellow fibres surrounding the articulation, and inserted on the margin of its articulating surfaces, and on the interarticular disc. It is strengthened externally by a strong band of white fibres (*Lig. maxillæ laterale externum*.)

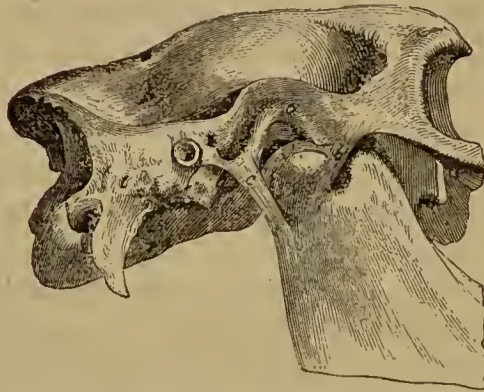


Fig. 145.—(LEYH.)—*a*, Interarticular cartilage; *b*, The band of fibres strengthening the capsular ligament anteriorly; *c*, Posterior elastic band.

Extending from the supra-condyloid process of the temporal bone, and from the depression behind this process to the

posterior border of the inferior maxillary bone below its neck, is an elastic band (*Lig. maxillæ posticum*), mention of which is omitted by some recent French authors, though of indisputable existence.

By its outer surface it responds anteriorly to the temporal and masseter muscles, posteriorly to the parotid gland, externally to a subcutaneous fibrous aponeurosis, and internally to the external pterygoid muscle. Its inner aspect responds to the interarticular fibro-cartilage and the synovial membranes.

Two syno-  
vial mem-  
branes.

The joint is provided with two synovial membranes, one above, and one below the interarticular disc.

Mobility of  
the joint.

The movements of the lower jaw are somewhat extensive, consisting of *depression*, *elevation*, *lateral motion*, and *horizontal gliding*.



The two first of these, or the opening and closing of the jaws, are common to all hinge joints, and might be performed equally well without the intervention of the fibro-cartilage; in relation to the two last-named movements, however, the great importance of this structure is at once recognised. During *lateral movement*, the jaws are carried alternately from right to left and from left to right; the condyle on one side is accordingly fixed, while the other describes the arc of a circle, being alternately advanced forwards and inwards upon the temporal condyle, and retracted backwards and outwards into the glenoid cavity, in which motions it carries with it the yielding fibro-cartilage. In horizontal gliding, also, which takes place in a forward and backward direction, both condyles of the lower jaw are alternately advanced on the temporal condyles, and retracted into the glenoid cavities, carrying, as before, the fibro-cartilages along with them.

*Differences.*—In *pigs*, the horizontal, or antero-posterior action of the jaws, is favoured by the great diameter of the articular surfaces from before backwards, and by the absence of the supra-condyloid process. Pig has condyles longer from before backwards.

In *carnivora*, the condyles of the lower jaw are retained in the glenoid cavities even after the removal of ligaments. This perfect adaptation gives great precision to the depression and elevation of the lower jaw, but necessarily checks both lateral and horizontal motion. As might be expected with such an arrangement, the inter-articular fibro-cartilage is extremely thin. Carnivora.

#### HYOIDEAN ARTICULATIONS.

The hyoid bone joins with the temporal on each side, its various parts, at the same time, articulating between themselves. The former are called the temporo-hyoidean, the latter, the interhyoidean articulations.

The *temporo-hyoidean articulations* are amphiarthrodial, being formed between the superior extremity of the large cornua of the os hyoides and the hyoid processes of the temporal bone, through the intervention of an elastic fibro-cartilage on each side. The cartilage is about a third of an inch in length, and of such elasticity as to permit a fair amount of motion between the bones. Hyoid and temporal bones united by fibro-cartilage.

The *inter-hyoidean articulations* on either side consist in a joint between the great and small cornua, and one between the latter and Four inter-hyoid joints.



Union of the  
two cornua.

The body  
and small  
cornua join  
by diarthro-  
dial joints.

Pig.

Ox has two  
additional  
interhyoid  
joints.

the body. *A.* The two cornua are bound together by an elastic fibro-cartilage, which forms the apex of an acute angle resulting from the union of the two bones. The union is, accordingly, by amphiarthrosis, but the elasticity and flexibility of the uniting medium permits of free opening and closure of the angle. In the substance of the cartilage a small bone is frequently met with. *B.* The small cornu joins the body by a diarthrodial joint. The articulating surfaces are—a small articular cavity on the extremity of the cornu, and a small rounded facet at the origin of the lateral branch from the hyoid bone. Both are covered by cartilage of incrustation, and they are bound together by a fibrous capsule (*Lig. capsularia ossis hyoidei*), having on its inner surface a synovial membrane. It is capable of all the varieties of motion, though in every direction this is somewhat limited.

*Differences.*—In the *pig*, the large cornu is bound to the *os hyoides* by yellow elastic tissue only. In the *ox* there is an additional interhyoidean, amphiarthrodial articulation on each side, in consequence of a third pair of cornua being developed.

#### ARTICULATIONS OF THE THORAX.

Divisions of  
the joints of  
the chest.

The joints of the thorax are divided into the following sets:—1st. Those connecting the vertebræ to the ribs—the *costo-vertebral*. 2nd. Those which join the ribs to their cartilages—the *chondro-costal*. 3rd. Those uniting the cartilages and the sternum—the *costo-sternal*. 4th. Those binding the cartilages to each other. 5th. Those proper to the sternum. 6th. Peculiar sternal articulations of the great ruminants and pig.

#### COSTO-VERTEBRAL ARTICULATIONS.

The joints between the ribs and the vertebræ are of two kinds:—1st. That by which the head of each rib is connected with the bodies of two vertebræ; and, 2nd. That by which the tubercle of the rib is united to the transverse process of the posterior of these vertebræ. The first is the true *vertebro-costal* joint; the second, the *costo-transversal*.

Articulation  
of the head  
with the  
vertebræ.

*A.* In the *vertebro-costal articulation*, the articulating surfaces are, on the part of the rib, two convex surfaces covered by cartilage of incrustation, and divided by a median asperous groove for the insertion of the interarticular ligament. On the side of the vertebræ, two concave facets, each excavated on the body of a separate vertebra,

and forming together the *intervertebral cavity*. Each facet is encrusted with cartilage, and separated from its fellow by the intervertebral disc, which lies at the bottom of the cavity.



Fig. 146.—(LEYH.)—*a*, The interarticular ligament in situ; *b b*, Branches of the same.

The means of union are:—1st. The *interarticular ligament* (Lig. Interarticular ligament), a short band, which, from the ridge separating the two articulating facets, runs upwards and inwards along the superior border of the intervertebral disc, to unite in the median line with its fellow on the opposite side. 2nd. The *costo-vertebral* (stellate; lig. colli costæ internum) is formed of three bundles of fibres, having a common attachment to the inferior surface of the head of the rib; it sends a bundle to the body of each of the vertebræ with which it articulates, the third going to the inferior border of the intervertebral disc. This ligament has on its inner aspect the synovial membranes, on its outer, the plenra. Stellate ligament.

The joint is provided with *two synovial membranes*, divided in the median line by the interarticular ligaments. They are in direct relation superiorly with the structures which pass through the intervertebral foramina. Two synovial membranes.

*B.* In the *costo-transverse articulation*, the surfaces of contact are a smooth diarthrodial facet on the internal aspect of the tubercle of the rib, and a similar facet on the external surface of the transverse process of the vertebra. Joint between the costal tubercle and the transverse process of the vertebra.

These are bound together by two ligaments: 1st. The *posterior* Posterior costo-transverse ligaments.



Fig. 147.—(LEYH.)—*a*, The internal ligament of the neck in situ; *b*, The anterior costo-transverse ligament; *c*, Intervertebral ligament; *d d*, Portion of the inferior common ligament of the vertebræ.

*costo-transverse* (Lig. transversarium externum), a thick bundle passing from the posterior border of the articulating surface on the

Anterior  
costo-trans-  
verse liga-  
ment.

transverse process, to the rough inarticulated part of the costal tubercle. It is related internally to the synovial membranc, and externally to the spinal muscles. 2nd. The *anterior costo-transverse* or *interosseous ligament* (Lig. transversarium internum) is a thick, short, bundle of white fibres, extending from the anterior aspect of the transverse process, near its base, to a roughened depression on the neck of the rib. Responding internally to the synovial membrane, its outer surface is in relation to the adipose tissue which separates this from the true costo-vertebral articulation. It has a single synovial membrane.

Synovial  
membrane.

#### PECULIARITIES IN SOME COSTO-VERTEBRAL JOINTS.

No inter-  
articular  
ligament for  
first rib.

The first, and sometimes the second costo-vertebral articulation, has no interarticular ligament, and only one synovial membrane. The first rib articulates with the last cervical and first dorsal vertebræ.

Both joints  
resolved into  
one in the  
three last.

The two or three last costo-transverse joints are confounded with the corresponding *costo-vertebral*; the synovial membranes of the latter are accordingly continuous with those of the former.

#### COSTO-STERNAL ARTICULATIONS.

We find on each side eight arthrodial or simple gliding articulations between the sternum and the lower end of the cartilages of the true ribs.

Eight in  
number on  
each side.

Each costal cartilage joins the corresponding fossa on the sternum by a rounded and oblong extremity.

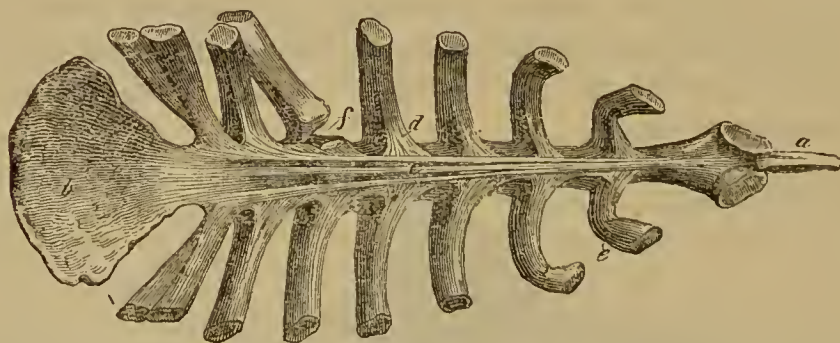


Fig. 143.—*a*, Cariniform cartilage; *b*, Ensiform cartilage; *c*, The upper sternal ligament; *d*, Radiated ligament of the sternum; *e*, Fibrous ligament of the articulation between the rib and its cartilage; *f*, An opened capsular ligament.

Capsular  
ligament.

These are surrounded by bundles of white fibres, forming a *capsular ligament* (Lig. capsularia cartilaginum costarum). The superior portion of this capsule, or *superior sterno-costal* ligament (Lig. radiatum), unites internally with the fibrous cord, which runs in an antero-posterior

Sup. sterno-  
costal liga-  
ment.



direction on the superior aspect of the sternum; it is covered by the triangularis muscle. The inferior portion, called also the *inferior sterno-costal* ligament, is in relation to the pectoral muscles.

Inferior  
sterno-costal  
ligament.

#### PECULIARITIES OF THE FIRST COSTO-STERNAL JOINT.

The articulation of the first costal cartilage with the sternum is confounded with that on the opposite side. The two *sternal* cavities are consequently turned upward in place of outward, and are continuous with each other. Each cartilage has a diarthrodial facet on its inner aspect, continuous with that on its lower extremity, by which it articulates with the opposite cartilage. The whole of this complex joint is supplied by a single synovial membrane. Each of the other costo-sternal articulations has a separate synovial membrane.

First pair of  
cartilages  
articulate  
between  
themselves,  
by diarthro-  
dial joint.

Synovial  
membranes.

#### CHONDRO-COSTAL JOINTS.

These joints are *synarthrodial* in the horse, being formed individually by the firm implantation of the cartilage at its upper end in the roughened fossa on the lower extremity of the rib. This union is very intimate, but its strength is much increased by the periosteum, which acts as a powerful enveloping capsule (Lig. fibrosa cartilaginum costarum).

Mode of  
union.

In the *ox*, the sternal ribs join their cartilages by true arthrodial articulations, which are each provided with a small synovial membrane.

In the *ox* by  
a diarthro-  
dial joint.

#### ARTICULATIONS OF THE COSTAL CARTILAGES WITH ONE ANOTHER.

The cartilages of the true ribs are joined, like the ribs themselves, by intervening muscles. Those of the asternal ribs, on the other hand, are placed in apposition to each other and bound together by yellow elastic ligaments. These ligaments extend from the anterior aspect of one cartilage to the posterior border of the one in front of it. The first of these is fixed to the last sternal by perichondrium as well as by short bundles of yellow fibres. It is also connected with the ensiform or xyphoid cartilage by a band of white fibrous tissue (chondro-xyphoid ligament), which covers and protects the internal abdominal artery.

By bands of  
yellow  
tissue.

#### LIGAMENTS PROPER TO THE STERNUM.

The pieces of the sternum are bound together by a strong ligamentous band on its superior aspect (Lig. sterni proprium superius), and another along its inferior border (Lig. sterni proprium inferius).

Proper ster-  
nal liga-  
ment.



## STERNAL ARTICULATION IN THE OX AND PIG.

Joint between the first and second pieces.

In these two animals the first piece of the sternum is not blended with the second, but they are connected by a diarthrodial joint. The articular surface of the anterior is slightly concave, that of the posterior convex. They are bound together by an expansion of white fibrous tissue, completely enveloping the joint, and bearing on its inner aspect a synovial membrane.

## MOVEMENTS OF THE ARTICULATIONS OF THE THORAX.

Gliding motion.  
Ribs rotate.

The *movements* of the thoracic articulations are those of simple gliding. In relation to the ribs, however, they fulfil to a certain extent the purposes of pivot joints. Each rib is curved outwards and backwards in its median part; when, therefore, the muscles act upon this portion anteriorly, it is pulled forwards and outwards, the two extremities, meanwhile, simply rotating in their former position. The increase of the cavity of the chest is attained by such an action, and its diminution is accomplished by an action exactly the converse.

## ARTICULATIONS OF THE FORE LIMBS.

## SCAPULO-HUMERAL JOINT.

Is ball-and-socket joint.

By the *shoulder joint* the scapula is connected with the humerus at an acute angle which opens posteriorly.

Articulating surfaces.

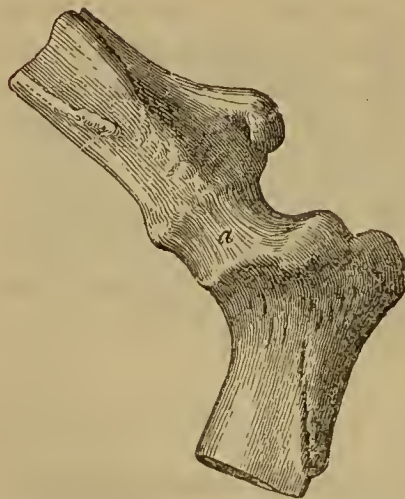


Fig. 149.—LEVER.—a, Capsular ligament of the shoulder joint, shown distended as after penetration of air between the articular surfaces.

The union is by enarthrosis, the articulating surfaces being, on the part of the scapula, a shallow oval fossa, with its greatest diameter from before backwards, with a slight notch internally, and a small depression near its centre; on the side of the humerus a rounded articular head placed between the tubercles, and like the glenoid cavity, sometimes bearing a slight depression. In the fresh state the notch in the margin of the glenoid cavity is closed by some white fibres, which represent the glenoid ligament of man.

It has only one ligament, the *capsular* (Lig. capsulare humeris brachii), which is fixed round the circumference of the articular head of the humerus and the margin of the glenoid cavity. It is strengthened anteriorly by two bundles of white fibrous tissue, which from the coracoid process diverge in passing downwards, and are inserted upon the internal and external tubercles.

The delicate connecting media of this ligament suggests to the mind the necessity of additional means of union; its strength is, however, greatly enhanced by the influence of atmospheric pressure, which effectually prevents the separation of the bones so long as the ligament is uninjured. When the joint is carefully dissected so as not to prick the capsular ligament, the bones remain in firm apposition, but if the scapula is held in one hand, and the capsule pricked, the humerus drops. The surrounding muscles effectually consolidate the parts. Thus we have: anteriorly, the coraco-radialis, the tendon of which is only separated from the capsule by some adipose tissue; posteriorly, the caput magnum of the triceps extensor brachii, and the scapulo-humeralis gracilis, a small muscle covering, and attached to, the capsular ligament, and supposed to prevent its being pinched during motion; externally is the teres minor or externus, and the tendon of the postea-spinatus, the latter of which is in close relation to the joint; internally the strong tendon of the sub-scapularis, also in close proximity to the capsule.

The joint is provided with a single synovial membrane, which covers the whole internal surface of the capsular ligament.

The *movements* in this, like in all ball-and-socket joints, take place in every direction. Thus it can perform the various actions of *flexion*, *extension*, *abduction*, *adduction*, *circumduction*, and *rotation*. The motions in these various directions are, however, much more limited than in the corresponding joint in the human being. This limitation is a necessary result of the retention of the humerus, as well as the scapula, on the lateral aspect of the thorax. In *flexion* and *extension*, the freest movements of which this joint is capable in quadrupeds, the humerus does not alone move; thus, in extension of the scapulo-humeral joint, not only is the lower end of the humerus brought forwards, but the lower angle of the scapula is at the same time carried upwards and forwards, describing, in fact, an arc of a circle, having its centre in the cartilage of the scapula. Flexion is accomplished by an action of the two bones exactly the converse of that just named.

Pig and dog. *Differences.*—In the *pig* and in *carnivora* the synovial membrane is extended downwards in front upon the bieipital groove, forming a cul-de-sac, and facilitating the gliding of the tendon of the coraeo-radialis.

#### HUMERO-RADIAL OR ELBOW-JOINT.

Is a hinge joint.  
Articulating surfaces.

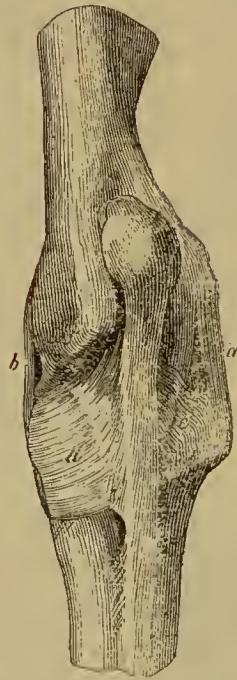
This is a ginglymoid articulation, formed by the union of the two bones of the fore-arm with the humerus. The *articulating surface on the part of the humerus* is elongated transversely and convex from before backwards, having a median sulcus in which is a small synovial fossa; on the outside of this sulcus is a shallow trochlea, and on its outer side a bulky condyle, the antero-posterior diameter of which is larger than that of the trochlea on the external side. The *articulating surfaces on the part of the radius and ulna* are exactly fitted to those on the humerus; thus, on the external side of the head of the radius are two antero-posterior

grooves, with a median eminence fitted exactly to the humeral trochlea; on the inner side is a glenoid cavity corresponding to the internal condyle; dividing these is an antero-posterior eminence, continued posteriorly by the ulna, where it forms the sigmoid notch. The upper surface of this ridge bears a synovial sulcus, existing on both its radial and ulnar parts.

The joint possesses *three ligaments*: two lateral, and an anterior.

The *external lateral ligament* (Lig. laterale externum) is a short but thick and powerful ligamentous cord, attached *above* to the epitrochlean crest, and the roughened cavity in the axis of the trochlea externally, and *below*, on the supero-external tuberosity of the radius. Its anterior border is continuous with the capsular ligament,

and gives attachment to some fibres of the extensor pedis; its posterior border is in contact with the flexor metacarpi externus; its internal



Ligaments.

External lateral;  
its attachments;

Fig. 150.—(LEYH.)—The outer lateral ligament of the elbow joint; *b*, The inner lateral ligament of the same; *c*, The outer, and *d*, the inner archiform ligaments of the ulno-radial joint. Below these the ulnar may be observed joined to the radius by interosseous ligaments.



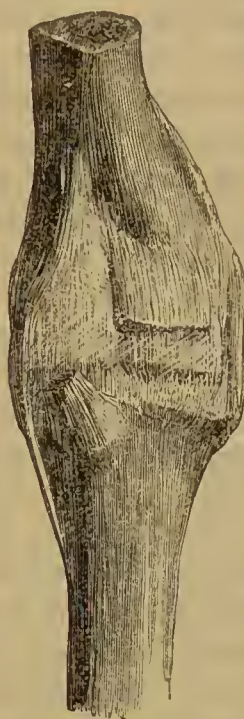
aspect is separated from the skin by some fibres of the extensor pedis, and by the fascia of the fore-arm, and its inner aspect is covered by the synovial membrane. The superficial fibres are vertical—the deep are directed from behind forwards and downwards.

The *internal lateral ligament* (Lig. laterale internum) is longer and less bulky than the external. It rises from a small tuberosity on the internal aspect of the humeral condyle, and its fibres expand as they descend upon the radius; the more anterior, which turn forwards, are continuous with the anterior ligament and the tendon of the coraco-radialis. The median fibres go straight downwards, to gain an insertion on some asperities beneath the bicipital tuberosity, while the posterior turn backwards inferiorly to join the archiform fibres of the radio-ulnar articulation. The median fibres of this ligament cover the lower insertion of the humeralis externus, and some fibres of the coraco-radialis; it is related externally to the ulnar nerve and the posterior radial artery and vein.

The *anterior or capsular ligament* (Lig. capsulare antibrachii) is an expansion of ligamentous tissue, attached upon the anterior margin of the articular surface of the humerus above, and of the radius below.

Its external half is composed of vertical fibres, which become inserted along with the coraco-radialis; its internal half is much thinner, and its fibres interlace, running in various directions. Both its internal and its external margins are continuous with the lateral ligaments. Lined internally by synovial membrane, it is covered externally by the anterior radial vessels and nerves, the coraco-radialis, and humeralis externus; the flexor pedis and extensor metacarpi magnus likewise take some insertions upon it.

The joint is thus closed in front, and on each side by ligaments; posteriorly it is closed only by the synovial membrane, the olecranon, and by various muscles—namely, the triceps extensor brachii, the



Fibres in two sets—crucial.

Internal lateral ligament. Attachments.

Relations.

Fig. 151.—This figure shows the capsular ligament with the external and internal lateral ligaments seen from the front. It also shows the tendon of the extensor metacarpi magnus above, and of the humeralis externus below.

Capsular ligament; placed in front of the joint.

Thinnest internally.

Relations.

anconeus, and the tendons of origin of the five flexors metacarpi and pedis.

Synovial  
membrane,  
has three  
prolonga-  
tions.

The *synovial membrane* surrounds the whole joint, being covered anteriorly and laterally by ligaments; posteriorly it is prolonged into three cul-de-sacs, a superior occupying the olecranean fossa, and two lateral, one on each side of the ulnar process; the external favours the gliding of the tendon of the flexor metacarpi externus, and the internal those of the other flexors over the head of the radius. It likewise sends a prolongation between the radius and ulna, to supply the facets by which these articulate superiorly.

Movements.

The *movements* of the joint are those of simple *flexion* and *extension*. During flexion the radius is carried in a slightly outward direction, as a consequence, not so much of the greater bulk of the internal condyle, as of the arrangement of the articular furrows in an oblique direction. *Extension* is limited by the tension of the lateral ligaments, and, in very extreme cases, by the beak of the olecranon, so that the arm and fore-arm can never be brought into the same line.

Dog and cat  
have a pad  
of fibro-car-  
tilage on the  
external  
lateral liga-  
ment.

*Differences.*—In the *carnivora* the external lateral ligament is of great size, and has developed on its lower part a fibro-cartilaginous mass, which gains insertions on the radius and ulna, and joins the annular ligament of the superior radio-ulnar articulation. It thus assists in the formation of the osseo-fibrous ring in which the head of the radius rotates in pronation and supination. The *internal lateral ligament* becomes inserted by two short bundles on the interior of the ulna and the head of the radius; a third bundle, strong, and placed between the two last, descends between the radius and ulna, and gaining the posterior aspect of the former bone, becomes inserted nearly along with the external lateral ligament.

Internal  
lateral liga-  
ment in dog.

#### RADIO-ULNAR ARTICULATION.

Articulating  
surfaces.

The radius and ulna respond to each other by two varieties of articulating surfaces, diarthrodial and synarthrodial.

Two diar-  
throdial,  
and four  
synarthro-  
dial.

The diarthrodial part consists of four facets, elongated transversely, and continuous with the elbow-joint. The two superior facets are respectively on the lower extremity of the sigmoid notch and the superior aspect of the radius; the two inferior, immediately behind, and communicating with these, are longer in a transverse direction, and are necessarily on the posterior aspect of the radius and the anterior of the ulna.

The superior synarthrodial surfaces are quadrilateral, and extend from the facets just mentioned to the radio-ulnar arch. The lower two are triangular with the apex inferiorly, and stretch from the above-named arch to the lower end of the ulna.

The bones are united by two *interosseous* and two *archiform ligaments*. The *interosseous ligaments* (Lig. interosseum) are formed of extremely short white fibres interposed between the synarthrodial surfaces, and binding them together with remarkable firmness. That for the triangular surfaces generally becomes ossified even before adult age; between the upper surfaces, however, ossification rarely takes place. The *archiform bands* (Lig. transversa radii et ulnæ externa et interna) are masses of white fibres stretching from the lateral (internal and external) aspects of the ulna to the posterior surface of the radius. Superiorly they extend from below the sigmoid notch to the superior border of the radio-ulnar arch. Below this arch, again, they extend to the lower end of the ulna. The superior fibres on each side join the lateral ligaments of the elbow, the internal becoming likewise continuous with the tendon of the humeralis externus at its insertion.

The *mobility* of the joint, which is extremely limited in the young animal, is almost abolished after the ankylosis of the lower joint.

*Differences.*—In the *full-grown ruminants* the upper as well as the lower synarthrodial surfaces have become ankylosed.

In *carnivora* the radius and ulna are never blended together. On the contrary, they enjoy considerable latitude of motion upon each other, being united at *either extremity* by a *diarthrodial joint*, and between these by an *interosseous ligament*.

The *superior radio-ulnar joint* is a pivot or lateral ginglymoid articulation, or, in more precise terms, the radius rotates in a cavity on the head of the ulna. The articulating surfaces are: on the part of the ulna, the lesser sigmoid cavity, immediately beneath the upper, arranged transversely, and semi-ovoid; on the part of the radius a semi-ovoid pivot corresponding to the sigmoid cavity. It has only *one ligament, the annular*, which attached upon the internal and external extremities of the lesser sigmoid cavity, forms three-fourths of a circle, which surrounds the head of the radius, and binds it to the ulna; the remaining fourth of the ring is formed by the sigmoid cavity. This ligament is attached on the outside to the external lateral ligament of the elbow, which has assumed a fibro-cartilaginous character at this part; anteriorly it is continuous with the anterior

Ligaments.

Interosseous.

Archiform.

Movements.

Bones of the fore-arm blended in the ox.

In dog and cat, the radius and ulna join by their shafts and extremities.

Joint between the upper extremities.

Radius rotates, in the sigmoid cavity,

and the annular ligament.



ligament of the same joint. The neck of the radius is covered by cartilage upon which this ligament plays, and has an extension of synovial membrane, which greatly facilitates movement.

Union of the shafts is by interosseous ligament.

The interval between the shaft of the radius and ulna, called also the *middle radio-ulnar joint*, is occupied by a single ligament only, the *interosseous*. This is composed of short white fibres descending obliquely from the radius to the ulna, and attached by their extremities on the contiguous aspects of those bones. The fibres are sufficiently long to allow a slight rotation of the one bone on the other.

Joint between the lower extremities.

The *inferior radio-ulnar joint* is, like the superior, a lateral ginglymoid articulation. It is formed by the reception of a rounded facet on the inner aspect of the lower end of the ulna, in a circumscribed, shallow cavity outside the lower extremity of the radius. These surfaces are retained in apposition by *two ligaments*, a *capsular*, and an *interosseous*. The *capsular* is very small, corresponding in size to the facets, and bears on its inner aspect a synovial membrane proper to the joint. The *interosseous ligament*, placed below the facets, attaches the bones in this situation, and, by its inferior aspect, forms part of the *radio-carpal articulation*.

Capsular ligament.

Interosseous ligament.

Movements.

The *movements* of these joints in the dog are necessarily more limited than in man, yet by the rotation of the radius in an outward direction, the metacarpus is brought into the position of *supination*, its dorsal aspect being turned outwards, while by a rotation in the opposite sense, pronation is induced, the dorsal aspect of the *metacarpus* in this case looking forwards.

#### RADIO-CARPAL JOINT.

Articulating surfaces.

The lower end of the radius joins the upper row of carpal bones by a ginglymoid articulation. The *radial articulating surface* is transversely elongated, and divided into an internal and an external portion. The *internal half* is a true condyle, limited anteriorly by a small glenoid cavity. The *external part*, less prominent than the internal, has on its surface a large groove, bounded anteriorly by a glenoid cavity, and posteriorly by a non-articular cavity, into which the process of the semilunar bone is received during extreme flexion. The articulating surface on the part of the carpus is exactly fitted to that of the radius, presenting in relief the parts corresponding to those excavated on the radius, and depressions where the latter bone has elevations. These surfaces are retained in apposition by *four ligaments* already described as common to the carpus, and, in addition,

Ligaments are seven in number.

by *three ligaments* proper to this articulation, which are arranged as follows:—The *internal* (Lig. carpi volare obliquum) is a rounded Internal. fibrous cord, running from the posterior part of the radius downwards and inwards, to be inserted upon the posterior aspect of the scaphoid; it is covered by the posterior common ligament. The *external* (Lig. External. volare ossis hamati et radii), partly covered by the external lateral ligament, unites the pisiform bone to the lower extremity of the radius. The remaining proper ligament is a delicate band, placed between Median. the other two, and attached superiorly to the radius; close to the insertion of the internal, from which point it spreads out in descending, and takes its lower insertions on the semilunar and the interosseous ligament that joins the cuneiform and pisiform bones.

## ARTICULATIONS OF THE CARPUS.

The carpus, being composed of an accumulation of small bones, presents numerous secondary joints. These may be considered as follows:—1st. The articulations between the first range of carpal Sub-joints of the carpus. bones. 2nd. The articulations between the bones of the second range. 3rd. The radio-carpal articulation. 4th. The articulation between the upper and the lower rows. 5th. The articulation of the lower row with the metacarpus.

*The following ligaments are common to the whole carpus, and do not belong exclusively to any of the subordinate joints. Two lateral, (internal and external), an anterior, and a posterior common.* Ligaments common to all the carpal joints.

The *internal lateral ligament* (Lig. carpi laterale internum), placed Internal lateral ligament. on the inner aspect of the carpus, is a strong fibrous cord, broader and thicker than the external. It takes its insertion superiorly upon Insertions. the internal tuberosity of the radius, passes down, gaining an attachment on the scaphoid in the upper row, and the trapezoid and magnum in the lower, to become ultimately inserted on the inner side of the cannon and the small internal splint. Related internally to the Relations. bones and synovial membranes of the carpus, it has on its outer surface the tendon of the extensor metacarpi obliquus; by its anterior border it is continuous with the anterior, and by its posterior with the posterior common ligaments.

The *external lateral ligament* (Lig. carpi laterale externum), placed External lateral ligament, is in two bundles. on the outer aspect of the carpus, is a powerful mass of white fibres in two bundles, crucially arranged in relation to one another. It is attached superiorly on the external tuberosity of the radius, sends Attachments. strong bundles to the cuneiform and uneiform as it passes over these

bones, and is inserted inferiorly on the head of the external splint. Responding, like the last, to the bones and synovial membranes internally, its outer aspect is played over by the tendon of the extensor suffraginis, its anterior border is continuous with the anterior, and its



Fig. 152.—(LEYH.)—*a*, The inner lateral ligament; *b*, The outer lateral ligament; *c*, The interosseous ligaments of the upper row; *d d d*, The interosseous ligaments of lower row.



Fig. 153. — (LEYH.)—*a*, Posterior oblique ligament of the carpus connecting the pisiform with the inner part of the knee; *b b*, Posterior common ligament.

posterior with the posterior common ligament. Its lower insertion is confounded with the inferior pisiform ligament.

Anterior  
common  
ligament.  
Insertions.

Relations.

The *anterior ligament* (Lig. carpi capsulare) is a broad membranous band, spread over the anterior aspect of the carpus. It is attached by its superior border to the anterior margin of the articulating surface of the radius, by its inferior to the anterior border of the head of the metacarpal bone, and on either side it is confounded with the lateral ligaments. By its inner surface it is attached to the synovial membranes of the articulations, and to the anterior aspects of the carpal bones and ligaments, the laxity of its different parts corresponding to the greater or less degree of motion possessed by the subordinate joints which it covers. Its external surface is related to the tendons of the extensors metacarpi and pedis. Its fibres run transversely and obliquely, intersecting each other in various directions.



The *posterior ligament* (Lig. carpi posterius), spread over the whole posterior aspect of the carpus, covers the several irregularities of the constituent bones. It is inserted by its superior border on the posterior margin of the radial articulating surface, by its inferior on

Posterior  
common  
ligament.  
Insertions.

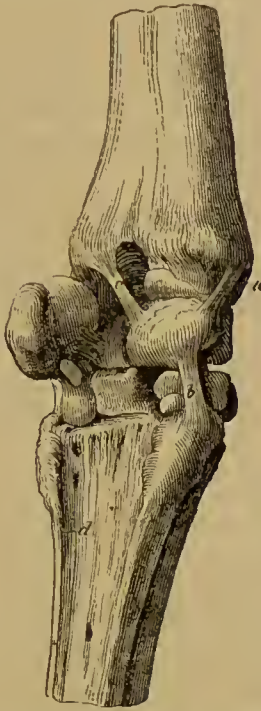


Fig. 154.—(LEYH.)—*a*, The supero-inter-nal ligament; *b*, The infero-inter-nal ligament; *c*, The oblique ligament; *d*, Inter-osseous ligament of the metacarpus.



Fig. 155.—(LEYH.)—*a*, The supero-external ligament; *b*, The infero-external ligament; *c*, The upper ligament of the pisiform; *d*, The middle ligament of pisiform; *e*, The inferior ligament of pisiform.

the margin of the articulating surface on the large metacarpal bone, where it becomes continuous with the suspensory ligament of the fetlock, and the metacarpal ligament of the perforans. Its internal border is confounded with the corresponding lateral ligament, while its external border is attached to the ligaments that join the pisiform to the external metacarpal and cuneiform bones. By its anterior surface this ligament is inserted upon all the carpal bones except the pisiform, its posterior surface is smooth for the gliding of the flexor tendons, and covered by the synovial membrane of the carpal arch. This ligament is possessed of great thickness and power.

Surfaces.

#### ARTICULATIONS BETWEEN THE BONES OF THE FIRST ROW.

The upper row consists of four bones, scaphoid, lunar, cuneiform, and pisiform, articulating together by arthrodial facets on their

The four  
bones re-  
spond by

diarthrodial  
facets.

Three an-  
terior and  
three inter-  
osseous liga-  
ments.  
Anterior.

Interosse-  
ous.

lateral aspects, which are variously divided by roughened furrows. They are maintained in position by *six ligaments* (Lig. intermedia), of which *three* are *anterior*, and *three interosseous*. The *anterior* are represented by flattened bundles of fibres, running transversely from the anterior surface of each bone to the corresponding aspect of the next bone. The external ligament (Lig. volare ossis hamati et multanguli), lies on the outer aspect of the joint, in consequence of the posterior position of the pisiform bone, and its outer surface accordingly responds to the external lateral ligament and the tendon of the flexor metacarpi externus. The others are attached by their external surface to the anterior common ligament. The interosseous ligaments take their insertions in the roughened furrows which divide the diarthrodial facets. The external one which joins the pisiform to the cuneiform, is attached firmly to the posterior common ligament. The other two which join the scaphoid to the lunar, and this latter to the cuneiform, are continuous anteriorly with the corresponding anterior ligaments.

#### ARTICULATIONS BETWEEN THE BONES OF THE SECOND ROW.

The three  
bones join  
each other  
as in the  
upper row.  
Two an-  
terior and  
two interos-  
seous liga-  
ments.  
Anterior.

The three bones composing the lower row, articulate with each other like in the upper row by arthrodial facets, disposed on their lateral surfaces. They are bound together by *four ligaments* (Lig. intermedia), of which *two* are *anterior* and *two interosseous*. The *two anterior* are inserted, like in the upper row, upon the anterior aspect of the bones they unite. The external is adherent to the capsular ligament, the internal to the internal lateral ligament under which it lies.

Interosse-  
ous.

The *interosseous ligaments* are similarly disposed to those in the upper row. The internal only becomes continuous with its corresponding anterior ligament, the external being separated from the other anterior ligament by a diarthrodical facet.

#### ARTICULATION BETWEEN THE TWO ROWS.

Is a hinge-  
joint.  
Articulating  
surfaces.

This articulation is, like the radio-carpal, an imperfect hinge-joint. The articulating surfaces on the part of the upper row, are three glenoid cavities posteriorly, with two slightly convex surfaces in front; on the lower row, three posterior eminences, with two anterior slightly concave facets.

Three liga-  
ments pro-  
per to this  
joint;

This joint has *three proper ligaments* in addition to the common carpal ligaments. Two of the proper ligaments (Lig. intermedia)

running from the intervals between the bones of the upper row to the corresponding intervals in the lower row, are placed at the posterior part of the articulation, in front of the posterior common ligament. These are best seen by cutting through the anterior common ligament, and forcibly flexing the joint. The *internal*, the strongest, <sup>two inter-  
osseous,</sup> is attached superiorly to the scaphoid, and inferiorly to the trapezoid and magnum. The external is inserted on the cuneiform above, and the magnum below. The remaining ligament (Lig. volare ossis hamati <sup>and one  
posterior.</sup> unciformis et metacarpi), the strongest of the three, extends from the posterior border of the pisiform, downwards and forwards, to become inserted on the hook of the unciform and the head of the external metacarpal. (Fig. 153.) It is, accordingly, common to the carpo-metacarpal articulation as well. It is confounded laterally with the external lateral and the posterior common ligaments.

The synovial membrane of this articulation sends prolongations <sup>Synovial  
membrane.</sup> upwards between the three internal bones of the upper row, and downwards between the bones of the lower row, to supply the various diarthrodial facets by which these articulate.

#### CARPO-METACARPAL ARTICULATION.

The union between the carpus and metacarpus is not a ginglymus <sup>Is a gliding  
joint.</sup> like the two just described, but is a true arthrosis. The articulating <sup>Articulating  
surfaces.</sup> surfaces on each side consist in smooth facets continuous with, but slightly inclined from, each other. The anterior one is the largest, and has frequently a synovial fossa.

Beside the common ligaments of the carpus, this joint has six <sup>Three pairs  
of ligaments  
proper to  
this joint.</sup> ligaments (Lig. intermedia) proper to itself, namely, *two anterior*, *two posterior*, and *two interosseous*. Of the *anterior ligaments*, the *internal* is in two bundles, which, from the anterior aspect of the magnum, run downwards to be inserted on the anterior part of the head of the cannon; the *external*, going from the unciform to the head of the external splint bone, is covered by the external lateral ligament. <sup>Anterior  
pair;</sup>

The *posterior ligaments* are two short bands which run from the <sup>the posterior  
pair;</sup> two points of union of the three lower carpal bones posteriorly, to the adjacent margin of the metacarpal bone. They are inseparably united to the posterior common ligament, of which they may be considered as slight anterior prolongations. The *interosseous ligaments* <sup>the inter-  
osseous pair.</sup> originate in front of the posterior, between the bones of the lower row, and are inserted between the large and small metacarpal bones these, however, are not invariably present.



Synovial  
membrane.

The synovial membrane of this articulation communicates superiorly with that between the two rows; it sends one *enl-de-sae* upwards between the trapezoid and magnum, and two downwards, to supply the small diarthrodial facets between the large and small metacarpal bones.

Movements  
of the car-  
pus.

*The movements of this complex joint* (the carpus) are almost confined to *flexion* and *extension*. In the flexed condition, indeed, a slight *abduction* and *adduction* may likewise be performed with a corresponding limited amount of circumduction. During extension, however, the joint is so firmly bound together by the lateral ligaments, that any motion other than flexion becomes impossible.

Flexion and  
extension.

*Flexion* and *extension* are almost entirely accomplished between the radio-carpal articulation and that between the upper and lower rows, the lower row being so firmly bound to the metacarpus as to permit only the slightest gliding motion. During *flexion* the metacarpus is carried upwards, backwards, and slightly outwards, the lower row glides perceptibly forwards upon the upper, which in its turn glides backwards upon the radius. The outward motion is due to the thinness of the cuneiform bone and the smallness of the curve on the external part of the radial articulating surface. During flexion, the posterior ligament is relaxed, the tension of the lateral ligaments is relieved, and the anterior is put upon the stretch. So great is the tension upon this last during extreme flexion, that Rigot asserts that a horse can scarcely *come down* upon his knees without its being ruptured, and synovia escaping into the adjacent tissues. In *extension*, a process exactly the inverse of the preceding is induced, the metacarpus is carried downwards, forwards, and slightly inwards, the lower row glides backwards upon the upper, and the latter is carried forwards upon the radius. In this condition, the lateral ligaments and all the posterior, whether special or common, are rendered tense, while the anterior common is in a state of complete relaxation. In some horses, the abduction of the limb during flexion is so marked as to be unsightly. This may depend on a congenital turning inwards of the knee, or on the exaggerated size of the internal half of the radial articulating surface.

Abduction  
during  
flexion.

Use of the  
small bones.

The general arrangement of the bones composing this joint, and the gliding of the individual bones of the two rows upon each other, tend to disperse and deaden the shocks, and to obviate the injurious effects of concussion to which the limb is so frequently subjected.

Ruminants,

*Differences.*—In *ruminants*, the general plan upon which this

joint is constructed is somewhat similar, modified, however, by the circumstance, that two bones only exist in the lower row. The inward direction of the radius, and the outward course of the metacarpus in these animals, while tending to obstruct concussion, renders necessary a considerable increase in the size and strength of the internal lateral ligament. In these animals, the anterior common ligament is likewise strengthened by three fibrous bundles, one of which runs from the radius to the ulniform, a thinner one runs from the scaphoid to the ulniform, while the least runs from the inner bone of the lower row to the metacarpal. The modification in the form of the joint during flexion prevents these ligaments interfering with the due performance of that movement.

have only two bones in the lower row.

Strong internal lateral ligament.

Anterior common has three bundles.

In *carnivora* the general arrangement described holds good, the ligaments being modified by the number of bones in the different rows. The three anterior bundles seen in ruminants are common also to this class. The general laxity of the ligaments permits a greater degree of lateral motion.

Dog and cat.

More lateral motion.

#### INTER-METACARPAL ARTICULATIONS.

The principal unites with each of the smaller metacarpal bones by a diarthrodial joint superiorly, formed by the union of two small angular facets, and supplied with an extension of the synovial membrane of the carpus; below this the union is by two elongated, triangular, roughened facets, by which the bones are chiefly bound together. Their union is effected: superiorly, by the *lateral* and *posterior ligaments* of the *carpus*, also by some fibres from the superior insertion of the suspensory ligament of the fetlock; inferiorly they are united by an interosseous ligament (Lig. interosseum metacarpi), the fibres of which run from the roughened aspect of the splint bone downwards and forwards to that of the cannon. These ligaments are extremely short, and confine the movements within almost imperceptible limits. In old horses the bones are very frequently united by ossification.

Two kinds of opposing surfaces.

Ligaments,

interosseous.

*Differences.*—In the *ox* the single small metacarpal bone joins the large by a small diarthrodial joint, surrounded by some white fibrous tissue.

Ox.

In the *pig* the four metacarpal bones correspond to each other at the lateral aspects of their superior extremity by diarthrodial facets. These articulations are each bound together by three bundles of fibres, two on the anterior and posterior aspects, and the third between the

Pig has

dorsal, palmar, and in-

terosseous  
ligaments.

bones and just behind the articular facets. These ligaments correspond to the dorsal, palmar, and interosseous ligaments of man.

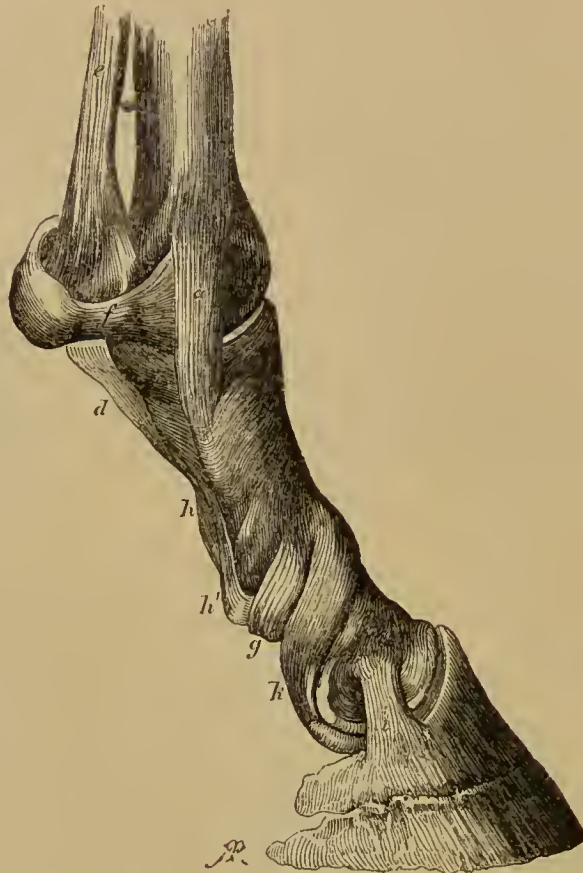


Fig. 156.

Figs. 156, 157, 158.—(LEISERING.)—Fig. 156 represents the ligaments of the phalanges from a lateral view, and figs. 157 and 158 from behind. The letters apply to the three figures. *a*, Outer lateral ligament of the fetlock joint; *b*, Intersesamoidean ligament; *c*, Suspensory ligament; *d*, Middle portion of the inferior sesamoidean ligament; *d'*, Lateral or V-shaped branches of the same; *e*, Crucial inferior sesamoidean ligament; *f*, Lateral ligaments of the sesamoid bones; *g*, Outer lateral ligament of the first phalangeal joint; *h*, Posterior median ligamentous branch of the first phalangeal joint; *h'*, Posterior outer band of the same; *i*, Outer lateral ligament of the foot joint; *k*, Superior lateral ligament of the navicular bone; *l*, Inferior broad ligament of the same.

Dog and cat  
like in the  
pig.

In the *carnivora* a similar arrangement exists, only the joints are possessed of a greater degree of mobility.

#### METACARPO-PHALANGEAN ARTICULATION.

Hinge-joint.

The joint formed by the union of the large metacarpal with the pastern and sesamoid bones is a true specimen of angular ginglymus.



On the side of the metacarpus, the articulating surface, which is elongated transversely and rounded from before backwards, is formed of two lateral condyles, separated by a median antero-posterior eminence; the internal condyle is the largest. On the part of the phalanges the diarthrodial surfaces are formed of two lateral glenoid cavities excavated on both the sesamoids and pastern, and separated throughout their whole extent by a median groove corresponding to the eminence on the metacarpal bone.

Metacarpal surface.

Phalangeal aspect.

Of the *ligaments* by which this joint is supported, some are proper *ligaments* in two sets.

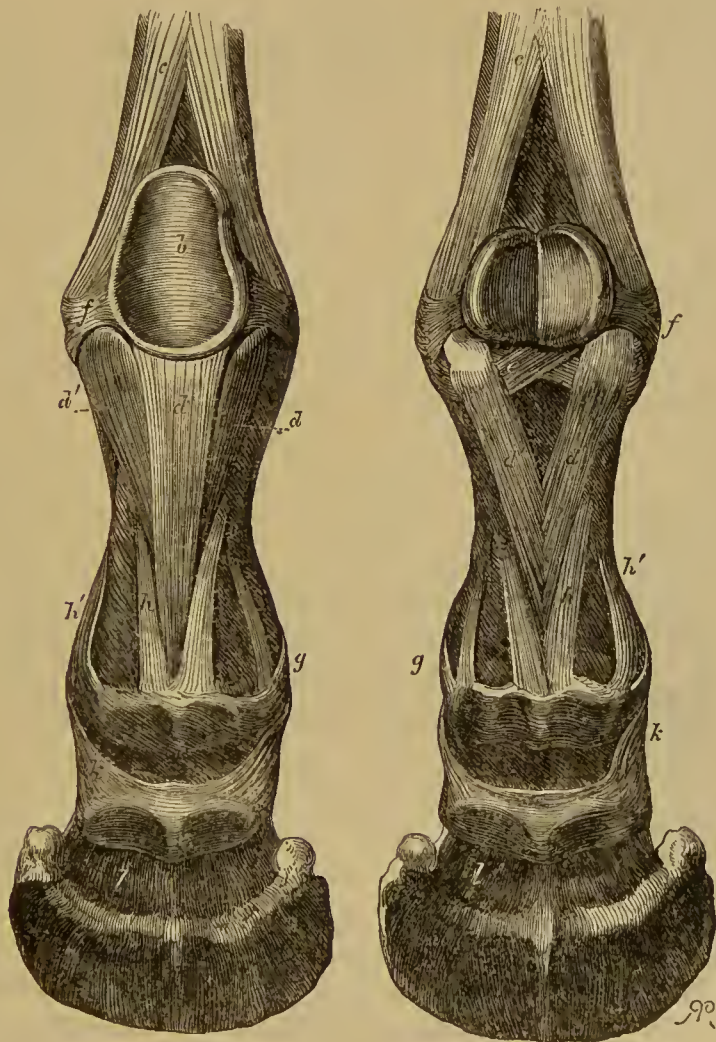


Fig. 157.

Fig. 158.

Figs. 157, 158—LEISERING—represent the ligaments of the phalange from behind. The letters apply also to Fig. 156, under which the description is given.

to the *pastern* and *sesamoid* bones, while others bind *these* to the *metacarpal*.

Those of the  
sesamoids.

1. To the former category six ligaments belong, namely, the *inter-sesamoid*, *two lateral*, and *three inferior*.

Inter-se-  
samoid.

The *intersesamoid ligament* (Lig. ossium sesamoideorum transversum) is a fibro-cartilaginous structure which binds the sesamoids together, and is at the same time spread over their posterior and external surfaces. It forms the bottom of the groove on their articular aspect, forms posteriorly a synovial groove over which the flexor tendons play, and affords a firm means of insertion for the ligaments attached to these bones.

Lateral  
sesamoid.

The *lateral sesamoid ligaments* (Lig. lateralium ossium sesamoideorum externa et interna) are two small bands which extend in a horizontal direction from the lateral aspects of the head of the pastern to the corresponding sesamoid bone. Responding internally to the synovial membrane, these are covered by the true lateral ligaments of the fetlock, by the digital vessels and nerves, and by the inferior branches of the great suspensory ligament.

Superficial  
inferior.

The *three inferior sesamoid ligaments* consist of a *superficial*, *median*, and *deep*. The *superficial* (Lig. volare rectum ossium sesam. inferius), the longest of the three, is straight and somewhat triangular, with its base turned upwards. It extends obliquely

upwards and backwards, from its lower insertion upon the fibro-cartilage that completes posteriorly the glenoid cavities on the superior aspect of the second phalanx, to take its attachment superiorly on the intersesamoidean ligament. It covers the lower part of the median ligament, and bears posteriorly the synovial membrane of the sheath of the perforans. The *median inferior ligament* is triangular, with its base superiorly. It is inserted inferiorly on some roughnesses near the lower extremity of the pastern bone, and divides as it ascends into a *median* and *two lateral bundles*, which become attached to the lower aspect



Median  
inferior.

Fig. 159.—(LEYH.)—*a*, Intersesamoidean ligament; *b*, Deep cruciate inferior-sesamoidean ligaments.

Deep or cru-  
ciate inferior.

of the sesamoids. The *deep ligament* (Lig. ossium sesam. cruciatum) is entirely covered by the median, except at its superior insertions, which are outside those of the latter. It is composed of two thin,

short, flattened bands, crossing each other in their course, and inserted on the base of the two sesamoids above, and on the postero-lateral parts of the head of the pastern bone below. It responds internally to the synovial membrane of the joint.

2. The ligaments of the metacarpo-phalangean joint are the following: *two lateral*, an *anterior* or *capsular*, and a *posterior* or *suspensory*. Metacarpo-phalangean ligaments.

The *internal* and *external lateral ligaments* (Lig. laterale nlnaris phalangis primæ, et Lig. lat. radialis phal. primæ) are each composed of a superficial and deep bundle of fibres which cross each other obliquely, but are most intimately connected by their corresponding aspects. The superficial part is attached to the metacarpal, just below the bottom of the splint bone, and descends vertically to get inserted on the lateral aspect of the head of the pastern. The deep part is attached to a small fossa in the axis of the corresponding condyle, and descends in a radiating manner to be inserted on the pastern, and the lateral aspect of the sesamoid, together with its lateral ligament. The superficial covers the anterior insertion of the lateral sesamoid ligament; the deep responds internally to the synovial membrane. Lateral crucial ligaments.  
Superficial bundle.  
Deep bundle.

The *anterior* or *capsular ligament* (Lig. capsulare phalangis primæ) is very thick and compact, being formed of fibres interlacing in various directions, and covering the whole front of the joint. It is inserted a little above the margin of the articulating surface of the metacarpal bone superiorly, and on the margin of the corresponding surface of the pastern inferiorly, becoming confounded on either side with the lateral ligaments. Its inner surface is covered by the synovial membrane of the joint, externally it lies in contact with the tendons of the extensors pedis and suffraginis, which are here slightly flattened, become attached to the ligament, and have each a synovial bursa to facilitate gliding. These bursæ do not communicate with the joint. Anterior ligament.  
Insertion.  
Relations.

The *posterior* or *suspensory ligament* of the fetlock (Lig. volare rectum ossium sesamoideorum superius) is a great band of white fibrous tissue, with, in most cases, a few muscular fibres, flattened from before backwards, and extending from the superior extremity of the cannon to about the middle of the os suffraginis. It is attached superiorly behind the head of the large metacarpal bone, where it is continuous with the posterior common carpal ligament, and to the heads of the two small metacarpals. From this it is directed downwards, filling up the groove formed by the splint bones laterally and the large metacarpal anteriorly. On reaching the lower third of Suspensory ligament.  
Form.  
Superior attachment.  
Course.  
Bifurcation.



the latter bone it bifurcates, leaving a triangular space into which extends a cul-de-sac of the synovial membrane. The two bands, into

which it divides, become inserted upon the sesamoids, and from each of these insertions a band continues the ligament downwards and forwards, crosses the superficial layer of the lateral ligament, and unites with the tendon of the extensor pedis, which it assists in retaining in its place.

A single *synovial membrane* encloses the joint and sends a prolongation between the two divisions of the suspensory ligament. The principal *movements* are those of *flexion* and *extension*; slight lateral motion may be accomplished during flexion, though, when the joint is extended, this motion is impossible.

*Differences.*—*Ruminants* having two digits have, in consequence, a double arrangement of the *metacarpophalangean articulation*. Each of these is like the simple joint in the horse, a true ginglymoid articulation.

There are *three intersesamoid ligaments*, one joining the sesamoids

Fig. 160.—(LEYH.)—*a*, Suspensory ligament; *bbb*, Inferior sesamoid ligament; *c*, Inter-sesamoidean ligament; *d d*, Posterior ligaments of the interphalangeal articulations; *e*, Posterior lateral ligaments of the navicular bone.



Lower  
insertions.

Synovial  
membrane.

Movements.

Double  
character  
of the joint  
in the ox.

Three inter-  
sesamoid  
ligaments.

Lateral  
sesamoid  
ligaments.

Lower  
sesamoid  
ligaments  
are four in  
number.

Four lateral  
metacarpo-  
phalangean  
ligaments.

proper to each of the digits, and a third joining together the sesamoids of one digit to those of the other. The *lateral sesamoid ligaments*, two in number, are stronger than in the horse, and join the first phalanx of each digit to the corresponding external sesamoid. The *inferior sesamoid ligaments* consist of four bundles for each digit. The *two lateral* of these run from the two sesamoids directly downwards, to be inserted on the postero-lateral aspects of the head of the first phalanx. The *median* cross each other, to be inserted in a similar manner on the first phalanx. The two lateral become respectively confounded by their superior attachments with the inferior branch of the suspensory and the interdigital ligament.

The *metacarpo-phalangean lateral ligaments* are *two* in number for each digit. The external homologates that of the horse, except in

this particular, that it has no insertion upon the sesamoid; the internal descends from the interarticular notch of the metacarpus to become inserted on some asperities on the inner aspect of the first phalanx, its fibres becoming confounded with those of the *superior interdigital ligament*. The *interdigital ligament*, placed between the phalanges, and binding them together, has its fibres arranged in a Superior interdigital ligaments. *perneal* manner, and inserted by their extremities on the inner aspect of the first *phalanx*. The *anterior* or *capsular* ligament, like in One capsular ligament only. *solipedes*, is single, and becomes confounded on either side with the lateral ligaments.

The *suspensory ligament*, much larger than in the horse, divides into eight bands as it approaches the lower end of the cannon. Two The suspensory ligament divides into eight inferiorly. of these leave the tendon about the middle of the bone just named, unite with the tendon of the *perforatus*, and assist in forming the double ring for the passage of the two tendons of the *perforans*. Four others are inserted upon the sesamoids, a pair for each digit; the external cord of each pair is extended forwards to join the *extensor tendon*. The internal sends some fibres to the *interdigital ligament*. The two last of these cords are placed deeply in the median line of the *metacarpus*, penetrate the interarticular notch, in which, as a single bundle, they separate the *internal metacarpo-phalangean* ligaments from each other, and lastly diverge, to be attached to the *extensor tendons* of the two digits. In the *sheep*, each *internal metacarpo-phalangean* ligament sends a bundle of fibres backwards, from its inferior extremity, to support the small bone in the posterior rudimentary claws. The *interdigital* is little developed. In the sheep.

In the *pig*, the articulating surfaces of the two principal *metacarpo-phalangean* joints are not so oblique as in the ruminants, and as a consequence, the toes are not so readily separable. In the two posterior joints, the metacarpal surface is a trochlea in its posterior, and a condyle in its anterior half. In the *carnivora*, the articular aspect of the metacarpal bone has a median eminence in its posterior two-thirds, but in front of this appears like a single condyle; the phalangeal articular surface is formed to correspond. Pig has less oblique surfaces of contact.

In the *pig* and *carnivora* we have for each digit: an intersesamoid, an inferior crucial sesamoid, and two small lateral sesamoid ligaments; two lateral *metacarpo-phalangean*, which take their inferior insertion upon the sesamoids, as well as the first phalanx, and an anterior capsular, having in its centre a minute anterior sesamoid bone, to facilitate the gliding of the *extensor tendon* of the corres- Articulating surfaces in dog and cat. Ligaments of this joint in the carnivora and pig.

Suspensory  
ligament  
replaced by  
muscles.

ponding digit. Each of these joints has a separate synovial membrane. Some fibres between the superior extremities of the first phalanges of the great digits homologate the superior interdigital ligament of the ox. In both pig and carnivora the suspensory ligament is replaced by true interosseous palmar muscles.

#### FIRST INTER-PHALANGEAN ARTICULATION.

Hinge joint.

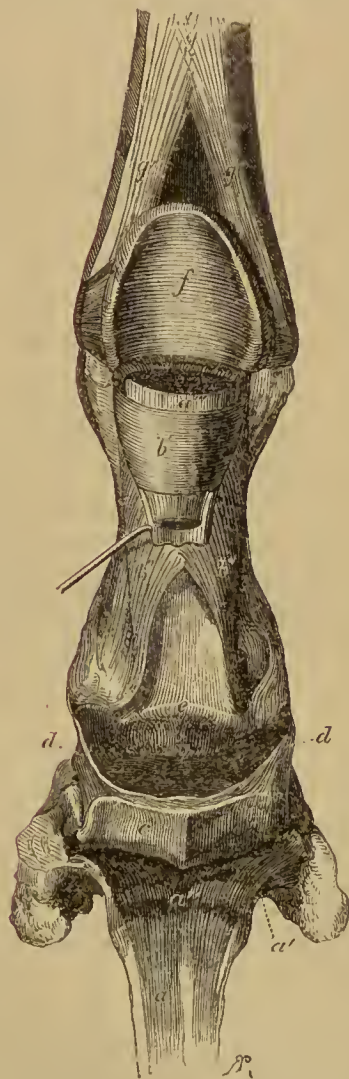
Articulating  
surfaces.

Cartilagin-  
ous pad on  
the os co-  
ronæ.

Ligaments.

Posterior  
ligament.

The first unites with the second phalanx by a ginglymoid joint.



The articulating surface of the first phalanx presents two lateral condyles, divided by a median antero-posterior groove; that of the second phalanx consists of two lateral glenoid cavities, divided by a median eminence. These cavities are extended posteriorly by thick and compact fibro-cartilage, attached upon their posterior margin, and moulded upon the condyles of the first phalanx. This structure, which may be considered as a part of the posterior ligament, has a polished posterior aspect, forming a sort of fixed sesamoid for the play of the perforans. This joint is possessed of *three* ligaments—a *posterior* and *two lateral*.

The *posterior ligament* is represented by six fibrous bands continuous with the superior border of the *glenoid fibro-cartilage*. The two lower pairs go to each side of the lower end of the os suffraginis; the remaining two extend upwards on each side of the inferior sesamoid ligaments to be inserted on the posterior border of the os suffraginis about its middle. They embrace the inferior sesamoid

Fig. 161.—(LEISERING.)—Posterior view of the right fore digit. *a*, Lower end of the perforans tendon divided and reflected downwards; *a'*, Broad part for insertion into os pedis; *a''*, Depression in which the prominence of the navicular bone is received; *a'''*, Portion of the perforans tendon where it is held by an annular ligament; *b*, Tendon of the perforatus; *b'*, Annular ligament of the same; *b''*, Insertion of the same; *c*, Navicular bone; *d*, Posterior ligament of the second phalangeal joint; *e*, Posterior surface of the os coronæ over which the perforans glides; *f*, Gliding surface for the flexor tendons over the sesamoid bones; *g*, Suspensory ligament; *g'*, Branches of the same.



moid ligaments, and are continuous by their lateral borders with the lateral ligaments and tendons of the perforatus.

The *lateral ligaments*—external and internal—are two flattened bands *attached* superiorly into the fossæ in the axis of the condyles of the first phalanx, and directed downwards and backwards to gain the lateral aspects of the os coronæ, and the extremities of the navicular bone. Each is attached by its anterior border to the tendon of the extensor pedis, and by its posterior to the posterior ligament and glenoid cartilage. That portion which extends to the navicular bone forms the posterior lateral ligament of the coffin-joint. Lateral ligaments.

The tendon of the extensor pedis is spread out on the anterior aspect of this joint, and supplies the place of a capsular ligament. No anterior capsular ligament.

The tendon of the perforatus affords mechanical support to this joint, holding a position, in relation to this and the preceding articulation, similar to that of the suspensory ligament in regard to the latter. This tendon is attached to the posterior aspect of the radius by means of the radial ligament, so that between this point and its insertions on the os coronæ, it is a comparatively unyielding cord, well calculated to prevent undue extension either of this or of the metacarpophalangean articulation. Action of perforatus tendon.

The *synovial membrane* encloses the whole joint, and presents a single cul-de-sac posteriorly, which extends a short distance on the posterior aspect of the os suffraginis. Synovial membrane.

The *movements* of this joint are those of flexion and extension only. During *flexion* the anterior bundles of the lateral ligament are rendered tense, while the posterior bundles, the posterior ligament, and the perforatus tendon are relaxed; in the flexed condition a slight lateral and rotatory movement is allowed. During *extension* the os coronæ glides forwards on the os suffraginis; the posterior fibres of the lateral ligaments, the posterior ligament, and the perforatus tendon are put upon the stretch, while the anterior fibres of the lateral ligaments are relaxed. When extended this joint admits of no lateral movement. Movements.

*Differences.*—In the *ox* and *sheep*, we have two such joints for each limb. The articulating surfaces of each resemble those of the same joint in the horse, with this difference, that the external condyle and glenoid cavity are invariably larger than the internal. The *posterior ligament* in these animals consists of two bundles only. The *internal lateral ligament* is composed of two bundles, one of which goes to the lateral aspect of the second phalanx, and the other to that of the Ox and Sheep.

third. The *external lateral ligament*, much thinner than the internal, is also prolonged upon the lateral aspect of the third phalanx, so that these lateral ligaments represent also the anterior lateral ligaments of the second interphalangean articulation in solipedes.

Pig.

The *pig* has four of these joints in each limb, the articular surfaces of which resemble those of the ox. The glenoid fibro-cartilage is connected to the os suffraginis by areolar tissue only. The *internal lateral ligament* extends only to the lateral aspect of the second phalanx, the *external lateral* sends a prolongation to be inserted on the outer extremity of the small sesamoid bone.

Dog and cat.

The first *inter-phalangean joints* of *carnivora* correspond in number to that of the digits of these animals. The *glenoid cartilage* is united to the first phalanx by areolar tissue only. The *lateral ligaments* are inserted on the lateral aspect of the first and second phalanges.

#### SECOND INTER-PHALANGEAN ARTICULATION, OR COFFIN JOINT.

Is a hinge joint, with limited motion.

Articulating surfaces.

From the union of the os coronæ with the os pedis and navicular bone, there results a ginglymoid joint, possessed of limited mobility.

Joint between the navicular and coffin bones.

The articulating surface on the part of the second phalanx consists, like that on the lower end of the first, of two condyles, separated by a median groove; that on the coffin and navicular bones is formed of two corresponding glenoid cavities, with a median eminence. The navicular joins the coffin bone by a small arthrodial joint, each having a transversely elongated diarthrodial facet, continuous above with the superior articulating surface of the respective bones, and bounded below by an asperous furrow for the interosseous ligament.

Coffin joint has five ligaments.

The *ligaments* of the joint are *five in number*.—one, the *interosseous*, being single; and four, the *anterior* and *posterior lateral*, being arranged in pairs. In addition to these ligaments, however, there is a band of union through the lateral cartilage by the coronary ligament of the latter (*b*, Fig. 162), and the attachment of the cartilage to the os pedis.

Interosseous ligament: its insertions

and relations.

The *interosseous ligament* (Lig. ossis navicularis inferius), which binds the navicular to the coffin bone, is formed of short, white fibres, inserted posteriorly in the groove beneath the transverse facet on the sesamoid, and anteriorly below the corresponding facet on the os pedis. It responds superiorly to the synovial membrane of the coffin joint, and inferiorly to that of the navicular bursa, and to an anastomotic branch of the plantar veins. To expose this ligament, the ten-

don of the perforans must first be detached, and raised from the navicular bone.

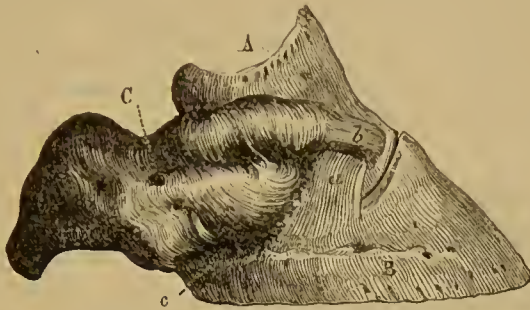


Fig. 162.—(LEISERING.)—A, Os coronæ; B, Os pedis; C, Lateral cartilage; a, Outer lateral ligament of the coffin joint; b, Coronary ligament of the lateral cartilage; c, Junction of the lateral cartilage with the os pedis.

The *anterior lateral ligaments* (Lig. lat. ulnaris et radialis phalangis tertię) are two flattened, but thick and compact bundles of short fibres, attached above on the lateral roughness on the inferior extremity of the second phalanx, and below in two fossæ, at the base of the pyramidal process, becoming continuous also with the lateral fibro-cartilages. It is confounded anteriorly at its insertion with the tendon of the extensor pedis, and responds internally to the synovial membrane of the joint.

Ante  
lateral  
ligament;  
where  
attached.

The *posterior lateral ligaments* (Lig. later. ulnare et radiale phalange primæ et tertię) hold a position in this joint very similar to that of the suspensory in the pastern, and the perforatus tendon in the first interphalangean articulation. Each of these originates by two bundles, one of which, as already noticed, is simply a continuation of the lateral ligament of

the joint just-named; the other is attached to the second phalanx, just behind that ligament. These, uniting, form a single cord, which, running downwards and backwards, gets inserted on the extremity of the navicular bone, and, joining the ligament from the opposite side, forms a fibrous cushion, and extends the surface of gliding

Posterior  
lateral  
ligament  
has arrange-  
ment like  
the sus-  
pensory  
Superior  
origin.

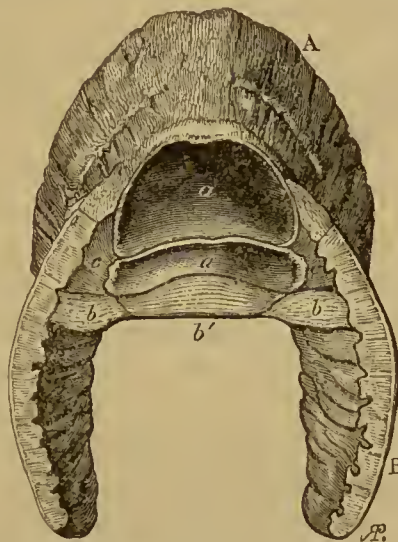


Fig. 163.—(LEISERING.)—A, Os pedis; B, Lateral cartilage cut horizontally and seen from above: a a, Joint formed by the upper part of os pedis and navicular bone; b, Portion of the lateral ligament of the navicular bone; b', Posterior surface of the navicular bone; c, Lateral ligament of the coffin joint divided.

Attachment  
to the navi-  
cular bone,  
to basilar  
process and  
lateral  
cartilage.



presented by this little sesamoid to the perforans tendon. From each extremity of the navicular bone the corresponding ligament is prolonged by two small bundles, which proceed respectively to the basilar process, and the inner aspect of the fibro-cartilage on that side to which they belong. This ligament responds internally to the synovial membrane, and externally to the lateral cartilages and plantar cushion.

Relations.

Muscles  
which act as  
ligaments.

The union is further strengthened by the tendons of the extensor and flexor pedis, which are flattened out, and applied over the anterior and posterior aspects of the joint.

Synovial  
membrane.

The *synovial membrane* which surrounds this joint, is prolonged to form three cul-de-sacs, one of which extends upwards on the posterior aspect of the second phalanx, and lies in relation to the posterior lateral ligaments; a second descends under the facets by which the little sesamoid responds to the os pedis, and the third, which is very small, fills the interval between the anterior and posterior lateral ligaments.

Movements.

The *movements*, like in the joint immediately above, are confined to *flexion* and *extension*, with a slight *lateral motion*, most marked during flexion.

In the ox  
have  
trochlear  
surfaces.  
Seven liga-  
ments.  
Inter-  
osseous.

Ant. lateral.

*Differences.*—In the *ox* the superior articulating surfaces are trochlear, and are slightly inclined towards the axis of the member. The joint is possessed of seven ligaments, an *interosseous*, *two pairs of lateral*, an *anterior*, and an *interdigital*. The *interosseous* holds a position analogous to that of the same ligament in the horse. The *anterior lateral* have their superior insertions on the lower end of the first phalanx; the external expands inferiorly, and is closely adherent

Post. lateral.

to the extensor tendon, by which it is nearly covered. The posterior lateral ligaments, the internal of which is of yellow elastic tissue, run from the lateral part of the second phalanx to the little sesamoid.

Anterior.

The *anterior ligament* is a yellow elastic band, extending from the superior extremity of the second phalanx to be inserted on the third in the space left between the internal anterior lateral ligament and the tendon of the extensor. The *inferior interdigital ligament* is

Inferior  
interdigital.

formed of two bundles of fibres, which run obliquely from either side, and cross and interlace with each other in the median line. The lower bundle on each side is much shorter than the upper, and gets inserted on the inner extremity of the small sesamoid and the internal aspect of the third phalanx, its fibres becoming confounded with the perforans tendon, the plantar cushion, and the coronary substance.

The superior bundle extends over the tendon of the perforans, which it binds firmly in its place, and becomes attached on either side to the outer aspect of the lower end of the second phalanx, some of its fibres going to a fibrous sheath, which envelopes the whole digital region posteriorly. In the *sheep* this last ligament is much more simple, being composed of transverse parallel fibres only, inserted at each end on the internal extremities of the two small sesamoids.

The *pig* has *four ligaments* for this joint, *two lateral*, an *anterior*, and a *posterior*. The *lateral* extend from the lower end of the second phalanx, upon each side, to the corresponding aspects of the third. The *anterior* exactly homologates that of the ox. The *posterior* represents the outer ligament of the posterior lateral in the horse, having its insertions on the lower end of the first phalanx, and on the outer extremity of the little sesamoid. That corresponding to the internal is wanting.

The ligaments of this joint in *carnivora* are very simply arranged. *Two lateral* for each joint are simply inserted on the adjacent extremities of the bones. An *anterior*, composed of yellow elastic tissue, and divided into two lateral bundles, extends from the second phalanx to get inserted on the pyramidal eminence on the superior aspect of the distal phalanx. By the elasticity of this ligament the claw is always retracted upwards and backwards, unless when the flexor muscles are brought into play. This ligament is very effective in the *cat*, and generally retains the distal phalanx laid backwards between the others. A pad of fibro-cartilage completes the posterior margin of the articulation on the distal phalanx, and serves as a sesamoid for the passage of the flexor tendon.

#### ARTICULATIONS OF THE HIND LIMBS.—SACRO-ILIAC ARTICULATION.

This is an amphiarthrodial joint, resulting from the union of one of the innominate bones with the transverse process of the sacrum upon the same side.

The *articular surfaces* are, on the part of the sacrum, an irregularly triangular and slightly undulating diarthrodial facet, surrounded by an asperous surface for the insertion of the interosseous ligament. This is met by a surface exactly analogous on the inner aspect of the ilium.

The joint is possessed of *four ligaments*, an *interosseous*, a *superior* and *inferior sacro-iliac*, and a *sacro-sciatic*.

The *interosseous*, (Lig. interosseum), formed of short but powerful

bundles, completely surrounds the articular facet, and gaining insertions on the contiguous roughened aspects of the bones, binds them together in the most intimate manner. Its inferior part is related to the iliacus, its superior to the longissimus dorsi muscle.

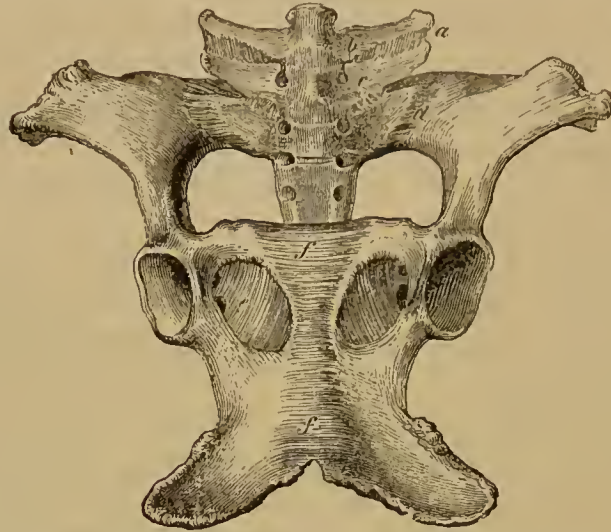


Fig. 164.—(LEYH.)—*a*, Inter-transverse ligament of the lumbar vertebræ; *b*, Joint between transverse processes of two last lumbar vertebræ; *c*, Sacro-lumbar joint; *d*, Sacro-iliac ligament; *e*, Obturator foramen; *f*, Ligament of the ischio-pubic symphysis.

Superior  
ilio-sacral.

The *superior ilio-sacral ligament* (Lig. ilio-sacrum laterale) is a short but powerful band, extending from the internal angle of the ilium to the sacral spine, where it is confounded with the supraspinous ligament.

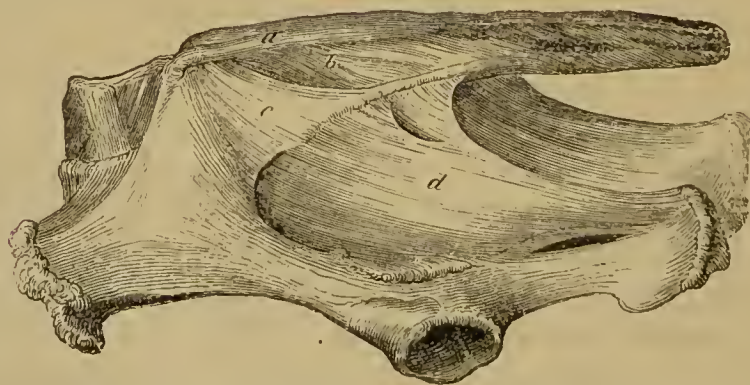


Fig. 165.—(LEYH.)—*a*, Superior ilio-sacral ligament; *b*, Inferior ligament; *c*, Inferior ilio-sacral ligament; *d*, Sacro-sciatic ligament.

Inferior  
ilio-sacral.

The *inferior ilio-sacral ligament* (Lig. ilio-sacrum laterale anticum) is a strong membranous mass, placed in front of the sacro-



sciatic ligament, of which it seems a continuation. From the internal angle and posterior border of the ilium, it extends vertically upwards, to be inserted on the supra-spinous ligament along with those last described. It is related to the gluteus medius externally, and the lateral sacro-coccygeal muscle internally.

The *sacro-sciatic ligament* (Lig. tuberoso et spinoso sacrum) is a great irregularly quadrilateral membranous expansion, placed, as its name indicates, between the sacrum and ischium, forming the posterior part of the lateral walls of the pelvis, and at the same time giving additional firmness to the sacro-iliac articulation.

Its superior border is inserted on the lateral margin of the sacrum. Its inferior border, inserted on the posterior border of the ileum, the supra-cotyloid crest, and the ischiatic tuberosity, has a notch between the two last-named insertions for the passage of the pyriformis and internal obturator muscles. The anterior border, small and not well defined from the last-described ligament, has a great notch (great sciatic) for the passage of the gluteal vessels and nerves and the sciatic nerves. The posterior border divides into two folds, which enclose the semi-membranosis. It is confounded superiorly with the coccygeal aponeurosis. The external surface bears the sciatic nerves and gives attachment to the median gluteus, the abductor magnus, and the semi-tendonosis muscles. The internal surface is in contact with the peritoneum anteriorly, and gives attachment to the ischio-coccygeal and ischio-anal muscles posteriorly.

The *synovial membrane* is very limited, corresponding to the size of the diarthrodial facet.

The *movements* of this joint are extremely limited, yet the slight mobility it possesses may be highly useful in obviating injury from the concussion to which this part is necessarily exposed by its position in connecting the hind extremity to the trunk.

#### ARTICULATION BETWEEN THE INNOMINATE BONES, OR ISCHIO-PUBIC SYMPHYSIS.

This joint is formed by the union of the internal borders of the two pairs of pubic and ischiatic bones. Although an amphiarthrodial joint in the young, the parts become completely anchylosed in most domestic animals, even at an early age. It has interosseous cartilage covered above and below by transverse fibres.

The *cartilage*, which is simply implanted in the rugosities of the two surfaces, is constantly ossified in the adult solipedes, and in the

Transverse  
fibres.

males of the bovine, and many other races. The transverse white fibres (Lig. transversum) are internally bound to the cartilage in their passage from one bone to the other, and become continuous on either side with the periosteum, of which they seem to be dependencies. That below the symphysis is much the stronger.

Mobility.

The *movement* of the joint is exceedingly restricted in the young animal and absent in the old.

Seldom an-  
chylosed in  
many female  
domestic  
animals.

*Differences.*—In most female animals, as in the cow, sheep, bitch, and the females of the goat, rabbit, and cat, the ossification of this cartilage takes place late, if at all.

#### HIP JOINT.

Is a ball-and-  
socket joint.

This is an enarthrosis or ball-and-socket joint, formed by the reception of the globular head of the femur into the cup-like cavity of the acetabulum. The cotyloid cavity has a notch in its internal margin, which being covered by the cotyloid ligament, is converted into a hole; in its bottom is a depression, destitute of cartilage of incrustation, and giving insertion to the round ligament. The head of the femur is smooth, covered by cartilage of incrustation, except at its internal aspect, where there is a roughened fossa for ligamentous insertion.

Articulating  
surfaces.

Ligaments.

This articulation possesses *three ligaments* proper, the *capsular*, the *pubio-femoral*, and the *round*; to these may be added the *cotyloid ligament* or *fibro-cartilage*.

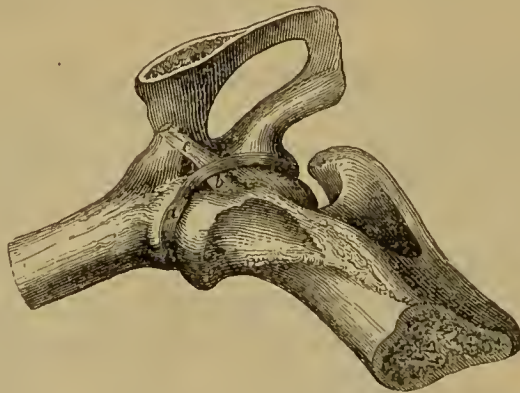


Fig. 116.—(LEYN.)—*a*, Cotyloid ligament; *b*, Ligamentum teres; *c*, Pubio-femoral ligament.

Cotyloid.

The *cotyloid ligament* (Lig. cotyloideum) is a prismatic ring of fibro-cartilage, fixed on the circumference of the acetabulum, enlarging that cavity, and by the inward direction of its free margin embracing the

head of the femur. This ligament is strongest in front and behind. It bridges over the notch in the wall of the cavity, and is covered on both internal and external aspects by synovial membrane. Forms the notch into a hole.

The *capsular ligament* (Lig. capsulare femoris) is a broad tubular membrane completely enclosing the joint, attached round the neck of the femur by its lower circumference, and round the margin of the acetabulum and the cotyloid ligament by its superior. It is formed of interlacing fibres, and is strengthened anteriorly by a bundle of fibres which descend obliquely upon the femur, along with the ilio femoralis gracilis and rectus femoris. Its external surface, covered by a thin layer of adipose tissue, responds anteriorly to the two muscles just named, posteriorly to the gemini, obturator internus, and pyriformis, externally to the glutens internus, internally to the obturator externus. Capsular lig.

The *round ligament* (ligamentum teres) is a short, powerful cord, which, notwithstanding its name, has a somewhat triangular form. Its superior extremity is inserted in the anterior half of the fossa in the depth of the cotyloid cavity, its inferior extremity, along with the pubio-femoral ligament, into the fossa on the head of the femur. It is surrounded by synovial membrane. Round ligament.

The *pubio-femoral ligament* originates from the strong tendon by which the abdominal muscles are attached to the pubic symphysis, runs outward in the subpubian groove, pierces the notch of the acetabulum, sending some fibres to its fibrous bridge, and becomes inserted, along with the round ligament, into the fossa on the head of the femur. Under the pubis it lies between the two heads of the pectineus, in the acetabulum it is enveloped by synovial membrane. Pubio-femoral ligament.

The *synovial membrane* covers the inner surface of the capsular ligament, and of the cotyloid fibro-cartilage, envelopes the two inter-articular ligaments, and sends a prolongation into the fossa in the bottom of the cotyloid cavity. Synovial membrane.

The *movements* to which this joint may be subjected are of the most varied character. *Flexion* and *extension* can be most freely performed, but *abduction*, *adduction*, *circumduction*, and even *rotation*, may be exercised to a considerable extent. Movements.

*Differences.*—None of the domestic animals, except the horse, possesses a pubio-femoral ligament. Abduction is accordingly much less limited in our other domestic quadrupeds. In the *cow*, the cotyloid ligament attains its greatest bulk, the irregular character of circumference of the acetabulum necessitating this development. Absence of the pubio-femoral ligament in other domestic animals.



## FEMORO-TIBIAL ARTICULATION, OR STIFLE JOINT.

**Joint.** This is a ginglymoid joint, formed by the condyles of the femur above with the head of the tibia below, and of the patella with the femoral trochlea in front.

**Surfaces of contact.**

The *articular surfaces* on the femur are:—posteriorly, two condyles elongated in an antero-posterior direction, and separated by the deep and non-articular intercondyloid notch; anteriorly, a trochlea continuous behind with the intercondyloid notch, and having its inner lip disproportionately greater than the outer. These lips differ from the condyles, inasmuch as the inner condyle is the smaller. On the part of the tibia, there are the two lateral slightly convex articular surfaces upon its head, rising on the lateral aspects of the tibial spine, and separated by the groove on the summit of that process.

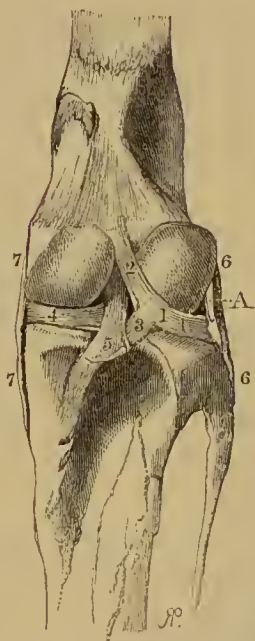


Fig. 167.—1, External semilunar cartilage; 2, Fibrous attachment of the same to the femur; 3, Fibrous attachment of the same to the tibia; 4, Internal semilunar cartilage; 5, Tibial insertion of the posterior division of crucial ligament; 6, External lateral ligament; 7, Internal lateral ligament.

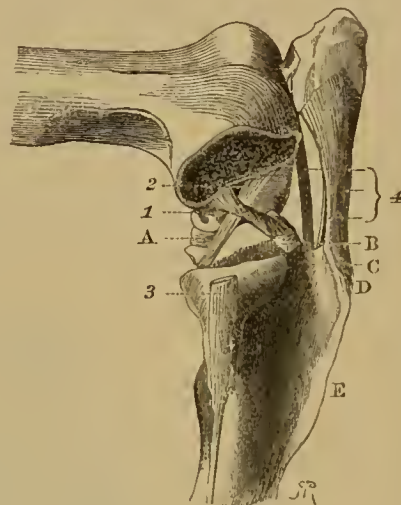


Fig. 168.—A and B, Semilunar cartilages; C, Notch for the passage of the tendon of the flexor metatarsi and extensor pedis; D, Antero-superior tuberosity of the tibia; E, Tibial crest; 1, Anterior division of crucial ligament; 2, Posterior ditto; 3, Peroneal insertion of the external lateral ligament of the stifle joint; 4, Inferior ligaments of the patella.

On the part of the patella, two lateral depressions with a median eminence, which imperfectly fits the femoral trochlea.

Interposed between the articulating surfaces of the femur and tibia are two crescent-shaped, complimentary structures (cartilaginee semilunares), composed of fibro-cartilage, and attached to the two bones between which they are interposed. Their inferior surfaces, by which they are applied upon the head of the tibia, are flat; their superior are concave, adapting them to the condyles of the femur; their external borders are thick and convex, attached to the capsular ligament and synovial membranes of the joint, their internal are thin, sharp, and concave, applied round the tibial spine, and leaving the internal part of the articular surface uncovered. Their extremities end in ligaments, by which they are attached to the tibia and femur. The *internal semilunar cartilage*, broader, but thinner than the external, is attached by its anterior extremity to the groove at the base, and in front of the tibial spine (Lig. anticum cartilaginis semilunaris internæ), by its posterior, into the same groove, just behind the same eminence, and between the insertions of the two interarticular ligaments (Lig. posticum cartil. semil. internæ).

Semilunar cartilages.

Their aspects.

Internal semilunar cartilage, inserted by two lig. to base of tibial spine.



Fig. 169.—(LEISERING.)—A, Outer, and B, Inner semilunar cartilages; 1 1, Anterior ligaments connecting them with the tibia; 2 and 3, Bands of the crucial ligaments of the stifle joint; 4 4, Lateral ligaments cut across.

The *external disc* is attached in front, close beside the anterior insertion of the opposite cartilage (Lig. anticum cartil. semil. externæ), posteriorly it ends in two bands, the smaller of which (Lig. posticum inferius cartil. semil. externæ) is fixed on the postero-internal border of the tibial surface on which it lies, the larger (Lig. posticum superius cartil. semil. externæ), runs upwards and inwards over the outer condyle, to become inserted in the posterior part of the intercondyloid notch. The tendon of the popliteus plays over the outer border of this disc, and separates it from the external lateral ligament.

External semilunar cartilage inserted on the tibial spine.

The posterior border of the tibia,

and intercondyloid notch.

rates it from the external lateral ligament.

This joint possesses nine ligaments in all, which may be divided into:—1st, the ligaments of the patella; and 2nd, the ligaments binding the femur to the tibia.

Stifle joint has nine ligaments.

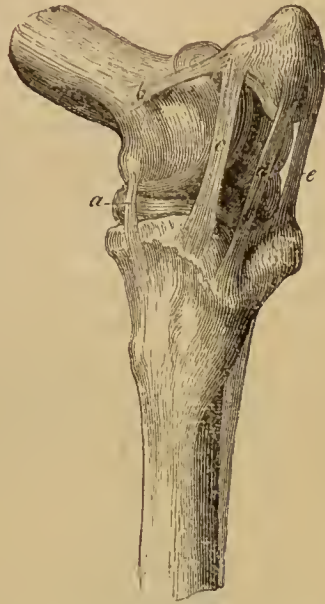
1st. The *ligaments of the patella* are four in number, of which three are *inferior* (*internal*, *external*, and *median*), and one is a *capsular*.

Ligament of patella.

The *internal ligament* (Lig. patellæ reetum internum) longer than, but not so thick as, the external, is attached by its inferior extremity

Internal.

upon the inner aspect of the anterior tuberosity on the head of the tibia, and by its superior end, on the antero-internal part of the patella, where it is flattened and covered by cartilage on its inner aspect, so as to extend the internal articular surface of that bone. It gives insertion above to the vastus internus, in front to the fascia lata, and internally, to the aponeurosis of the triceps adductor femoris.



Median.

Fig. 170.—(LEYH.)—*a*, Internal ligament of stifle; *b*, Band strengthening the capsular ligament of the patella, internally; *c, d, e*, Inferior straight ligaments of the patella.

The *external ligament* (Lig. patellæ rectum externum), the thickest of the three, is inserted below upon the summit of the anterior tuberosity of the tibia, and superiorly on a scabrous depression in front of the patella. It gives insertion externally to the aponeurosis of the abductor magnus, and internally to the fascia lata which unites it to the internal ligament.

The *median ligament* (Lig. patellæ rectum medium) is a rounded cord, inserted above on the antero-inferior aspect of the patella, and below, in the lower end of the groove on the anterior tuberosity of the tibia, having a synovial bursa to facilitate its gliding in the upper part of that sulcus. It is surrounded by a thick layer of adipose tissue, by which it is separated from the synovial membrane, the internal and external ligaments, and the fascia lata extending between these last.

Capsular

The *capsular ligament* (Lig. patellæ capsulare), covering the trochlear articulation above, and at each side, takes its insertions round the superior and lateral borders of the trochlea, and of the articular surface of the patella. It is much attenuated superiorly, but is strengthened laterally by two bundles of fibres, which might, without any impropriety, be considered as separate ligaments. The complementary bundle on the outer side is the stronger. To the inner surface of the capsule is attached the synovial membrane, to its outer, the rectus femoris, internal and external vasti, and the abductor magnus.

is strongest laterally.

Femoro-tibial ligaments.

External lateral.

2nd. The *femur* is joined to the tibia by *five ligaments, two lateral, a posterior, and two interarticular or crucial*.

The *external lateral ligament* (Lig. tibiæ laterale externum), shorter



and stronger than the internal, is a great fibrous cord, rounded at its median part, and flattened at its two extremities. It is inserted above in a fossa outside the external condyle of the femur, and below on the head of the fibula after passing over the outer tuberosity of the tibia when it has a small synovial bursa. It passes over the tendon of the popliteus, on which it sometimes glides by a small synovial bursa, and is covered in its turn by the aponeurosis of the leg.

The *internal lateral ligament* (Lig. tibiæ laterale internum) is a <sup>Internal lateral.</sup> long flattened band, inserted superiorly on a tubercle above the articular surface of the inner condyle, and inferiorly on some roughnesses about an inch below the inner margin of the internal tuberosity on the tibia. It is attached to the internal semilunar cartilage, and plays over the inner margin of the head of the tibia, supplied by a prolongation of synovial membrane from the joint. It is covered externally by the aponeurosis of the adductor muscles.

The *posterior* or *capsular ligament* (Lig. capsulare tibiæ) is a broad <sup>Capsular ligament,</sup> membranous expansion, formed of interlacing white and yellow fibres, and spread over the whole posterior aspect of the joint. It is attached superiorly above the condyles of the femur, and descends to <sup>one for both condyles.</sup> be inserted on the lateral ligaments, the popliteal tendon, the posterior border of the tibial surface, the posterior crucial ligament, and the semilunar cartilages. It is covered internally by synovial membrane where it embraces the condyles of the femur, and is in relation externally to the popliteal blood-vessels and the gastrocnemii muscles.

The *interosseous ligaments* are two strong fibrous cords placed in the intercondyloid notch, and crossing each other in a diagonal manner in their passage forwards and backwards, to be inserted on the head of the tibia. The *anterior*, (Lig. cruciatum anticum), which is <sup>Anterior.</sup> at once shorter, stronger, and more vertically placed than the posterior, traverses the intercondyloid notch in a direction from above, downwards, forwards, and outwards. Inserted above, on the inner aspect of the external condyle, it is attached below to the summit of the tibial spine. Its fibres are slightly spiral. The *posterior*, (Lig. <sup>Posterior.</sup> cruciatum posticum), directed backwards, downwards, and inwards, is attached superiorly in the intercondyloid notch, and below on a small tubercle on the postero-external margin of the inner tibial facet.

This joint has *three synovial membranes*, <sup>Stifle has three synovial membranes:</sup> one for the articulation of the patella with the femoral trochlea, and one for the articulation of each condyle with the head of the tibia. The first surrounds the articular surfaces of the patella and trochlea, lines the capsular liga- <sup>one for patella.</sup>

ment, and is prolonged superiorly, as a *cul-de-sac* beneath the insertion of the two vasti and rectus muscles. The two others are inserted round the articular surfaces of the condyles and the tibial facets, and cover the posterior and lateral ligaments, together with the small bundles which attach the semilunar cartilages. The external one covers the tendon of the popliteus, and sends a prolongation downwards in the groove on the anterior aspect of the tibia, to facilitate the gliding of the tendon common to the flexor metatarsi and extensor pedis. They are in contact anteriorly with that of the patella, with which one, or both, not unfrequently communicates. A thick layer of adipose tissue separates the three membranes from the inferior ligaments of the patella, and extends backwards into the inter-condyloid notch separating the anterior part of the two lateral from each other.

Mobility.

Flexion.

Extension.

Lateral ligament tense during extension.

Rotation.

Dog and cat have a transverse ligament of the fibro-cartilages. Only one inferior ligament of the patella. Pig and sheep. Synovial membrane single in these animals.

The *movements* of the joint are those of *flexion*, *extension*, and *rotation*. The two former are the most common. During *flexion* the tibia and semilunar cartilages glide backwards upon the condyles of the femur, the discs meanwhile gliding slightly forwards upon the tibia, and the patella downwards upon the femoral trochlea. The lateral ligaments are relaxed, while the capsular and inferior ligaments of the patella are rendered tense. In *extension* the gliding of the different surfaces upon each other takes place in a sense directly the reverse of that just named, the lateral ligaments being meanwhile rendered tense, and limiting the motion of the joint. *Rotation* is effected not alone by the slight rotary motion of the condyles in their glenoid cavities, but also by a corresponding movement of the semilunar cartilages on the head of the tibia.

*Differences.*—In *carnivora* the semilunar cartilages are joined together at their anterior extremities by a transverse bundle of white fibrous tissue. There is only one inferior ligament of the patella. In the posterior ligament are two small bones lying on the posterior aspect of the condyles, and giving attachment to the gastrocnemii muscles. In the *pig* we have two, and in the *sheep* only one inferior ligament of the patella. In all the domestic animals, other than the horse and large ruminants, the whole of this joint is supplied by a single synovial membrane.

#### PERONEO-TIBIAL ARTICULATION.

Arthrodial joint.

Surfaces for articulation.

The fibula is united to the tibia by an arthrodial joint, capable of very limited motion. It is formed by the union of a small diarthrodial facet, and surrounding roughened surface, on the head of the

fibula, with a corresponding surface on the external tuberosity of the tibia. The facets have a small synovial membrane, and are surrounded on all sides by short powerful fibres, (Lig. fibulæ capsulæ), by which the bones are intimately bound together. Below these surfaces the bones are united by two crucial bundles, (Lig. interosseum tibiæ et fibulæ), forming the superior part of the arch, (tibial arch), which gives passage to the anterior tibial artery and vein. Below this arch the shafts of the bones are united by a fibrous membrane, which diminishes in breadth as it passes downwards. The fibula is prolonged inferiorly by a tendinous cord, which bifurcates at the lower end of the tibia to join the two external lateral ligaments of the hock. The slight mobility of the fibula on the tibia seems chiefly intended to give a certain latitude to the movements of the external lateral ligament of the stifle, of which the former bone is a continuation.

Means of union.

Circumferential fibres round the facets.

Interosseous ligament and tibial arch.

Tendinous prolongation of the fibula.

Movements.

*Differences.*—In ruminants there is no such joint, the fibula being replaced by a fibrous cord.

None in the ox.

In *carnivora* the bones are joined by their shafts and extremities. The superior extremities are joined by two little facets, surrounded by some white fibres, and having a special synovial membrane. The inferior extremities are united by two facets, provided with an extension of the synovial membrane of the hock, and enveloped by their fibrous bundles. The shafts are loosely bound together by an interosseous ligament, broad superiorly, but short and thick in its inferior third.

In dog have three joints. Superior.

Inferior.

Median.

In the *pig* the arrangement is like in the dog, but the upper extremities are united by an interosseous ligament.

Pig.

#### ARTICULATIONS OF THE TARSUS OR HOCK.

Like the corresponding joint of the fore-limb, the tarsus is most conveniently considered as composed of a number of subordinate articulations. These are—1st, the tibio-tarsal; 2nd, the articulation between the bones of the first row; 3rd, that between the bones of the second row; 4th, the articulation between the bones of the two rows, and, 5th, the tarso-metatarsal articulation.

Composed of secondary joints.

#### TIBIO-TARSAL ARTICULATION.

This is a ginglymoid joint, formed by the union of two bones only, the tibia and astragalus.

Tibio-tarsal is a hinge-joint.

The *articular surfaces* are—1st, On the lower end of the tibia,

Articulating surface





Fig 171.—Internal view of hock joint, indicating the character of the surface, especially over the cuneiform bones and upper portion of the metatarsus, so frequently the seat of bony depositions.

two deep cavities compressed laterally, directed forwards and outwards, and separated by a median eminence, which bears a small synovial sulcus on its summit; 2nd, On the upper aspect of the astragalus a pulley, exactly moulded on the above.

It has *seven ligaments*—an *anterior*, a *posterior*, *two external lateral*, and *three internal lateral*. has seven ligaments.

The *anterior ligament* (Lig. tarsi capsulare) is a membranous ex- Anterior.  
pansion covering the articulation anteriorly, and composed of interlacing



Fig. 172.—(LEYH.)—*a*, The internal lateral ligament; *b*, The calcaneo-metatarsal ligament.



Fig. 173.—(LEYH.)—*a*, The outer lateral ligament; *b*, Anterior oblique ligament.

fibres, strongest externally. From the latter circumstance, bog spavin bulges to the inner side of the joint. It is attached superiorly, above Insertions.  
the anterior border of the tibial articular surfaces, and inferiorly on the astragalus, the scaphoid, the cuneiform magnum, and the astragalo-metatarsal ligament; its lateral borders are moreover fixed on the superficial lateral ligaments. It responds internally to the synovial Relations.  
membrane, and externally to the tendons of the extensor pedis and flexor metatarsi, from which it is separated by some areolar tissue,

traversed in its turn by the anterior tibial artery and some anastomosing venous trunks.

Posterior.

Attach-  
ments;

The *posterior ligament* (Lig. tarsi capsulare) is a second fibrous membrane, covering the joint posteriorly. Numerous fibres converge obliquely to the centre, where they form a fibro-cartilaginous thickening, over which plays the tendon of the flexor pedis. It is attached superiorly on the posterior border of the tibia, and inferiorly on the os calcis and astragalus, its lateral margins being confounded with the



Fig. 174.—(LEYH.)—*a*, Deep bundle of internal lateral ligament; *b b b b*, Interosseous ligaments.



Fig. 175.—(LEYH.)—*a*, Deep bundle of external lateral ligament; *b b b b*, Interosseous ligaments.

has synovial  
membranes  
on both  
aspects.

superficial and internal median lateral ligaments. It is covered on both aspects by synovial membrane, the external being to facilitate the gliding of the perforans tendons.

External  
lateral  
ligaments.  
Superficial.

The *external lateral ligaments* are designated the *superficial* and the *deep*. The *superficial* (Lig. tarsi laterale externum longum), the longer of the two, is rounded in its superior and flattened in its inferior half. Attached above on the external maleolus, behind the groove or the peroneus, it is inserted inferiorly on the astragalus, the os



calcis, the cuboid, and the large and external small metatarsal bones. It covers the deep ligament, the calcaneo-astragaloid, the cuboido-cuneiform, and the external tendon of the flexor metatarsi; externally it is subcutaneous. Anteriorly it assists in forming a sheath for the tendon of the extensor pedis; posteriorly it is confounded with the calcaneo-metatarsal ligament. The *deep external ligament* (Lig. <sup>Deep.</sup> tarsi laterale externum breve), much shorter than the other, is attached by one extremity on the anterior part of the outer maleolus, and running downwards and backwards, crosses the direction of the superficial, and is inserted on the external aspects of the astragalus and os calcis. It responds internally to the synovial membrane of the joint.

The *internal lateral ligaments* are three in number, *superficial*, <sup>Internal lateral ligaments. Superficial.</sup> *median*, and *deep*. The superficial (Lig. tarsi laterale internum longum) closely resembles the corresponding external. It descends from the internal maleolus, and, confounding itself with the posterior and astragalo-metatarsal ligaments, it takes its insertions on the tubercle inside the astragalus, on the scaphoid, two cuneiform, canon, and internal splint bones. The *median* (Lig. tarsi laterale in- <sup>Median.</sup> ternum breve) taking its upper insertion under that of the superficial, runs downwards and backwards, crossing the direction of that ligament, to get attached to the inner aspects of the astragalus and os calcis. It exactly repeats the external deep, and, like the superficial, expands as it passes downwards. The *deep internal ligament* is a minute <sup>Deep.</sup> fibrous band, attached to the tibia and astragalus, beneath the insertions of the median ligament. It is generally surrounded by synovial membrane.

The *synovial membrane* of the joint covers the inner aspects of the <sup>Synovial membrane.</sup> anterior, posterior, deep external lateral, and part of all the internal lateral ligaments. It is continuous in front with the synovial membrane of the joint between the two rows.

The *movements* of the joint are those of *flexion* and *extension* only. <sup>Mobility.</sup> In *flexion* the astragalus rolls forward on the tibia, and the posterior ligament is rendered tense. By the oblique character of the joint the foot is carried slightly outward, so that it does not come in contact with the limb. In *extension* the astragalus rolls in an opposite direction, and the anterior and superficial lateral ligaments are put upon the stretch.

## ARTICULATION BETWEEN THE BONES COMPRISING THE FIRST ROW.

- Is an arthro-  
dial joint. The astragalus unites with the os calcis by an arthro-dial joint, three or four facets on the surface of the one bone responding to a similar number on the other.
- Articulating  
surfaces. There are four *calcaneo-astragaloid ligaments* (Lig. intermedia), *two lateral, a posterior, and an interosseous*.
- Ligaments. The *two lateral, internal, and external*, are two flattened fibrous bands, expanding as they proceed downwards, and covered by the tibio-tarsal lateral ligaments. The external is the stronger.
- Two lateral. The *superior*, thick, and formed of short parallel fibres, extends from near the superior margin of the pulley of the astragalus to the contiguous margin of the os calcis. It responds superiorly to the synovial membrane of the tibio-tarsal articulation.
- Superior. The *interosseous ligament*, placed between the bones, is very strong, and is fixed on nearly all the rugose depressions that separate the facets.
- Inter-  
osseous. The *synovial membranes* of the two lower facets generally communicate with that between the two rows, those of the two upper with that of the tibio-tarsal joint. The two upper are sometimes distinct.
- Synovial  
membrane. Motion is scarcely perceptible.
- Mobility.

## ARTICULATION BETWEEN THE BONES OF THE SECOND ROW.

- Union is by  
arthrosis The four bones of the lower row articulate with each other as follows: the cuboid joins the scaphoid and cuneiform magnum by four facets, an anterior and a posterior for each. The posterior for the cuneiform is often absent; the scaphoid joins the two cuneiforms by a large, slightly convex facet on its lower aspect, and the two cuneiforms articulate by a single facet. The third cuneiform, when it exists, joins the second by a small facet.
- Surfaces of  
contact. There are *six ligaments* proper to this joint (Lig. intermedia), and three which are common to others. We shall first notice the former.
- Six liga-  
ments pro-  
per to this  
joint. *Two anterior*, called respectively *cuboido-scaphoid* and *cuboido-cuneiform*, pass from the anterior aspect of the cuboid to the anterior margins of the two bones whose names they bear. They circumscribe above and below the orifice of a vascular canal existing between these three bones.
- Anterior  
cuboido-  
scaphoid. *Two interosseous cuboido-scaphoid and cuboido-cuneiform liga-*
- Anterior  
cuboido-  
cuneiform. *ments* differ from the former only in being interposed between the
- Interosseous  
cuboido-  
scaphoid and

articulating aspects of these three bones. They form the superior and inferior walls of the vascular canal. cuboido-cuneiform.

An *interosseous scapho-cuneiform* binds the lower aspect of the scaphoid to the two cuneiforms. Interosseous scapho-cuneiform.

An *interosseous inter-cuneiform* binds the two cuneiforms together, and is confounded with the ligament just named. When a third cuneiform exists, there is an additional inter-cuneiform ligament. Interosseous inter-cuneiform.

The *three additional ligaments* are the superficial *internal lateral* already described, the *astragalo-metatarsal*, and the *posterior tarso-metatarsal*, to be hereafter noticed. Three additional ligaments.

The *synovial membranes* of this articulation vary with the surfaces of gliding. Generally a special one supplies the two posterior cuboido-cuneiform and cuboido-scaphoid facets. The anterior cuboido-scaphoid gets a prolongation from between the two rows, while the corresponding cuboido-cuneiform facet is similarly supplied by the tarso-metatarsal joint. Synovial membranes.

The *movements* are extremely limited.

Mobility.

#### ARTICULATION BETWEEN THE TWO ROWS.

This is formed by the union of the broad and nearly flat inferior articular surfaces of the astragalus and os calcis with those on the upper aspects of the cuboid and scaphoid. It has *six ligaments*, only one of which, the interosseous, is proper to the joint. Articulating surfaces.

The *two superficial lateral ligaments* of the tibio-tarsal joint.

Only one proper ligament.

The *calcaneo-metatarsal* (Lig. tarsi posterius) is a strong fibrous cord, which unites the posterior border of the os calcis to the cuboid and external metatarsal bones, confounding its inferior insertion with that of the external lateral ligament. It is contiguous to the last-named ligament outside, and to the posterior tarso-metatarsal inside. Lateral.

Calcaneo-metatarsal.

The *posterior tarso-metatarsal ligament* is a fibrous expansion of great strength and thickness, and having its fibres interlacing in various directions. It is attached to, and binds together all the tarsal and the three metatarsal bones, posteriorly. It is pierced by the vessels of the canal between the cuboid, scaphoid, and cuneiform bones. This ligament represents in the hind leg the posterior carpal ligament of the fore. It is covered posteriorly by the synovial membrane of the tarsal sheath for the perforans, and is continued inferiorly by the suspensory ligament of the fetlock. Its inner border is continuous with the superficial tibio-tarsal, and its outer with the calcaneo-metatarsal ligaments. Posterior tarso-metatarsal.

Covered by synovial membrane posteriorly.



Astragalo-  
metatarsal  
ligament.

Covers the  
antero-in-  
ternal part  
of the joint.

The *astragalo-metatarsal ligament* (Lig. tarsi anterioris) is a flattened expansion of white fibrous tissue, radiating from a tubercle on the internal aspect of the astragalus forwards and inwards on the front of the joint, and attached to the scaphoid, cuneiform, and large metatarsal bones. Its posterior border is confounded with the internal superficial lateral ligament.

Inter-  
osseous.

The *interosseous ligament* takes its superior insertion between the two bones of the upper row, and its inferior between the cuboid and scaphoid.

Synovial  
membrane.

A single *synovial membrane* supplies this joint. It communicates in front with the tibio-tarsal articulation, ascending between the astragalus and cuboid, and descends between the cuboid and scaphoid.

The joint has almost no mobility.

#### TARSO-METATARSAL ARTICULATION.

Articulating  
surfaces.

This joint is formed by the apposition of the angular facets on the lower aspect of the cuboid and two cuneiforms, to corresponding facets on the heads of the three metatarsal bones. These are bound together by *six ligaments*, the *two superficial lateral tibio-tarsal*, the *calcaneo-metatarsal*, the *posterior tarso-metatarsal*, the *astragalo-metatarsal*, and an *interosseous*. The latter, which is the only one proper to this joint, is divided into three bundles, the anterior and largest, taking insertion on two fossæ on the middle of the cuneiform magnum and large metatarsal bone, the two lateral in the intervals between the bones.

Ligaments  
six in num-  
ber.

Interosseous  
is only liga-  
ment  
proper to  
this joint.

Synovial  
membrane.

The *synovial membrane* of this joint extends upwards round the anterior cuboido-cuneiform and inter-cuneiform facets, and downwards into the intermetatarsal facets.

Mobility.

The movements are very limited.

Ox's tarsus.

*Differences.*—In *ruminants*, the chief differences depend on the variation in the bones and their articulating surfaces. The small bone representing the end of the fibula articulates with the astragalus and os calcis, and gives insertion to the external lateral ligaments.

Tibio-tarsal  
articulating  
surfaces not  
so oblique.  
Astragalus  
joins all the  
surrounding  
bones by  
trochleæ.  
No cuboido-  
scaphoid  
ligament.

The trochlea on the astragalus and the corresponding grooves on the tibia are in a true antero-posterior direction. The astragalus articulates with the os calcis by a trochlea, and the interosseous ligament is not so short. The same bone joins the scapho-cuboid bone by a trochlear surface, a greater mobility being in each case attained. From the union of the bones there are necessarily no cuboido-scaphoid ligaments.

The tarsus of the *pig* differs from that of the ox, in this mainly, Pig's tarsus. that the lower end of the fibula is continuous with its shaft, that the cuboid and scaphoid remain distinct, and that there are three cuneiforms. The ligaments are modified accordingly.

In *carnivora*, the lower end of the fibula articulates with the Dog's and cat's tarsus. astragalus only. The os calcis and astragalus do not unite by a trochlear joint. The latter bone joins the scaphoid by a true head, having considerable power of motion. There are five bones in the lower row, with a corresponding number of ligaments, arranged as in the horse.

## ARTICULATIONS OF BIRDS.

These are constructed, as a general rule, on the same principle as in the mammalia, greater or less modifications being introduced according to the differences in the osseous structure and requirement of the parts. In certain joints these variations are so extensive and peculiar as to call for particular notice.

### INTERVERTEBRAL ARTICULATIONS.

The *cervical joints* are chiefly remarkable for the form of their articulating surfaces, and their synovial membranes. The former, Joints of the cervical vertebrae. Articulating surfaces. as mentioned in the OSTEOLOGY, are convex in one direction, and concave in a direction crossing the first at right angles. The one surface is, as it were, moulded upon the other, and both are covered by cartilage of encrustation. They are not placed in direct apposition, but have, on the contrary, a thin fibro-cartilaginous disc interposed, Synovial membranes. and separating them at all points. The joint is possessed of two synovial membranes separated from each other by the inter-articular cartilage, the movements of which on the bones it facilitates.

In the *dorsal* and *sacral* regions, the different segments are consolidated into a single mass, and their joints are necessarily obliterated. Dorsal and sacral vertebrae are fixed.

The joints of the *coccygeal vertebrae* are mixed, being furnished with connecting discs of fibro-cartilage as in quadrupeds. The mobility is consequently much more restricted than in the neck. Joints of the tail are amphiarthrodial.

The *occipito-atloid articulation* is a true ball-and-socket joint. It is formed by the reception of the rounded occipital condyle into the cavity on the inferior part of the ring of the atlas. This articulation is possessed of extensive powers of motion, as is well illustrated by Occipito-atloid joint is an enarthrosis.

the facility with which the various movements of the head, and especially that of rotation, are performed.

#### ★ TEMPORO-MAXILLARY JOINT.

Joints of the mandibles.	In this articulation the condyles of the zygomatic portion of the temporal bone and of the lower jaw are separated from each other by the intervention of the tympanic bone. It is possessed of two synovial membranes and a capsular ligament, strongest in its postero-internal and postero-external parts. It is further strengthened by two ligamentous bands, one of which extends from the zygomatic process to a tubercle on the outer aspect of the inferior maxillary condyle; the other, also from the zygomatic process, runs directly backwards to take its insertion behind the articulating surface of the lower jaw. From the remarkable mechanism of this joint, it contributes not to the movement of the lower mandible only, but to that of the upper as well. The upper mandible is united to the cranium by cartilaginous or elastic bony plates, so that it may be raised without affecting the position of the head as a whole. It is not elevated by the direct action of muscles upon the jaw, but by a system of bones so arranged as to act upon that part. Thus the pterygoid bone is attached by its two extremities to the sphenoid and the inner aspect of the tympanic bone, its median part being at the same time applied, buttress-like, upon the posterior border of the palatine; the malar, on its part extends from the outer aspect of the tympanic to join the superior maxillary bone. Let it be further understood that two muscular slips from the base of the cranium run backwards to take insertion on the anterior process of the os quadratus, and the means by which the upper mandible is opened is apparent. From the contraction of the muscles just named, the square bones are pulled forwards, and the pterygoid and malar bones are pressed against the upper jaw, which in its turn moves upon the elastic plates. This movement may be readily imitated upon the skeleton by pressing forwards the square bones with the finger.
Synovial membranes.	
Ligaments.	
Union of the upper mandible with the cranium.	
Levers that raise the upper jaw.	
Square bones are pulled forwards by muscular bands,	
and work the levers.	



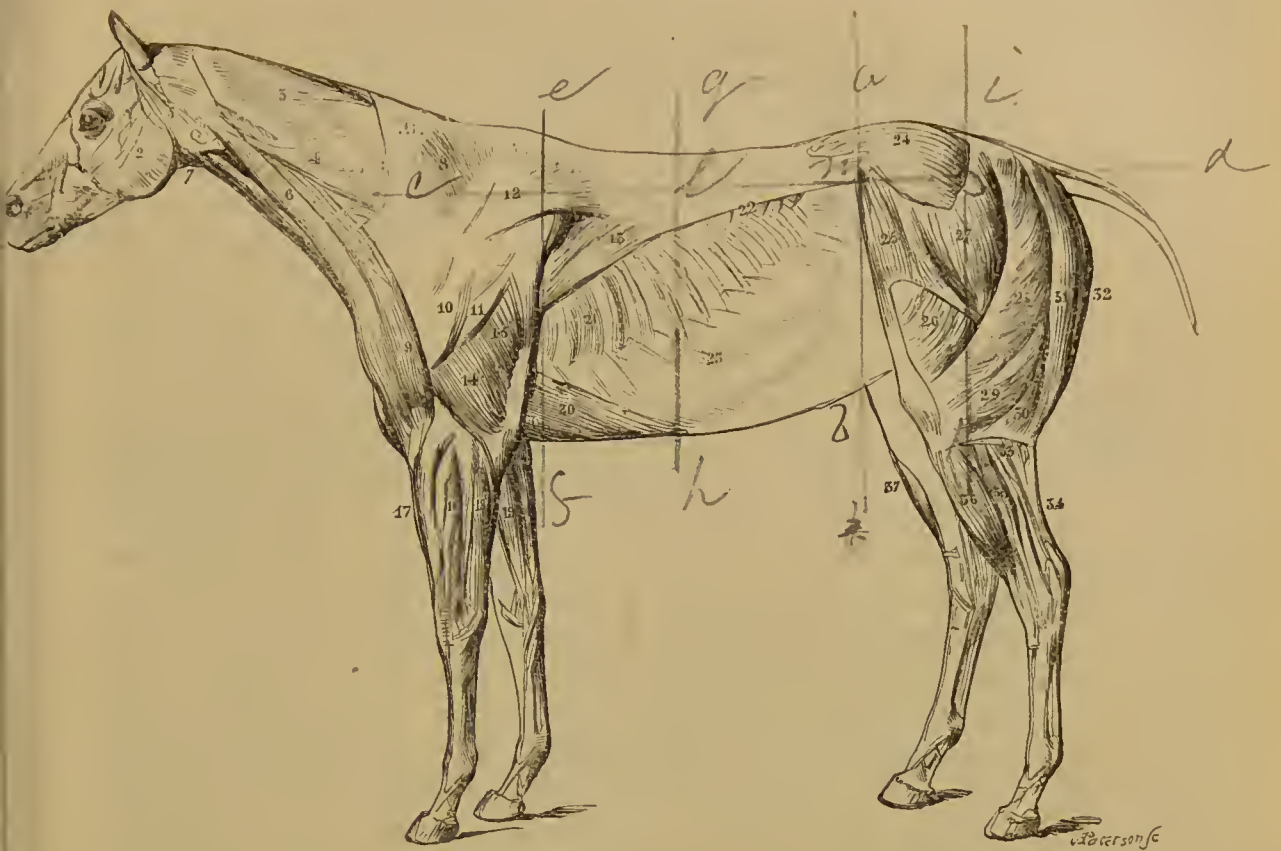


Fig. 176.

## INDEX TO THE ENGRAVING OF THE MUSCLES.

- |   |  |
|---|--|
| 1. Orbicularis oris.                              | 19. Flexor metacarpi internus.                     |
| 2. Masseter.                                      | 20. Pectoralis magnus.                             |
| 3. Splenius.                                      | 21. Serratus magnus.                               |
| 4. Cervical portion of serratus magnus.           | 22. Serratus parvus posticus.                      |
| 5. Parotido auricularis.                          | 23. External oblique.                              |
| 6. Inferior portion of the levator humeri.        | 24. Gluteus medius.                                |
| 7. Portion of the sterno-thyro-hyoideus.          | 25. Tensor vaginæ femoris.                         |
| 8. Cervical trapezius.                            | 26. Vastes externus.                               |
| 9. Superior portion of the levator humeri.        | 27. Gluteus externus.                              |
| 10. Anterior portion of the abductor brachii.     | 28. Anterior head of the triceps abductor femoris. |
| 11. Posterior portion of the same.                | 29. Median head of same.                           |
| 12. Dorsal trapezius.                             | 30. Posterior head of same.                        |
| 13. Latissimus dorsi.                             | 31. Semitendinosus.                                |
| 14. Caput medium of the triceps extensor brachii. | 32. Semimembranosus.                               |
| 15. Caput magnum of the same.                     | 33. Gastrocnemius.                                 |
| 16. Extensor pedis.                               | 34. Its tendon.                                    |
| 17. Extensor metacarpi magnus.                    | 35. Peroneus.                                      |
| 18. Flexor metacarpi externus.                    | 36. } Extensor pedis.                              |
|   | 37. }  |

## THE MUSCULAR SYSTEM.

Use of  
muscles.

Muscles constitute the active organs of locomotion, and they are disposed in groups and layers on the skeleton, in accordance with the construction of the latter, and hence suited to the special form and movements of different animals. They are so related to the nervous system as to be under the control of the will, though occasionally brought singly or collectively into play under the influence of stimuli, which act independently of the intervention of mental influence.

Colour of  
muscles—  
normal and  
abnormal.

In all mammalia the voluntary muscles are red in colour, varying in depth according to the amount of blood retained in the vessels after death, and often also as to the condition of that blood. This is well illustrated by the condition of the flesh of cattle slaughtered under different circumstances. It is normally of a bright scarlet hue, with a peculiar lustre; but if an animal is killed after severe exertion, the flesh is dark, and indeed often spoken of as 'black.' In disease, we find muscle assuming a parboiled appearance. The colouring principles of flesh and blood are the same, and bleeding animals before death, or thoroughly in the act of slaughtering them, tends to induce a pallor of their muscular apparatus.

Origin and  
insertion.

In the domestic mammals, and especially in the horse, we find the powerful muscles interspersed with strong fibrous tissue, continuous at the extremities with the bundles of white fibres, which serve to connect the muscles with bones or other structures. The tendinous attachment which is most fixed, is termed the *origin* of a muscle, whereas the part which is usually the one moved by the contracting muscle, is termed the insertion. The fleshy fibres collected into a mass, constitute the *belly* of a muscle, though, in some instances, the term *head* is applied to this portion.

Form of  
muscles.

Muscles, are long, short, or flat. In some of the largest muscles, the fleshy fibres run parallel without anastomosis from origin to insertion. In many instances muscles taper towards their tendinous ends, and we frequently observe in quadrupeds the attachment of fibres to intersecting bands of fibrous tissue, which pass, as stated above, through the whole substance of a muscle. In certain long muscles, the fibres are individually much shorter than the total length of the muscle, and they then pass from a broad surface of origin, to an extensive surface of insertion. This is well seen in the triceps abductor femoris.

According to the disposition of their fibres have muscles been <sup>Penniform, etc.</sup> classified as to shape. Thus a *penniform* muscle consists in one having a flattened mass of parallel fibres diverging from a central tendon of insertion. When the fibres are disposed parallel to each other, but obliquely to the surface of origin and tendon of insertion, so as to form a regular parallelogram, the muscle is called *semi-penniform*. A muscle may have two or three heads—*bicipital*, *tricipital*; or two bellies—*biventral* or *digastric*.

Groups of muscles are bound down by fibrous membranes termed <sup>Fasciæ.</sup> *fasciæ* or *aponeuroses*, which are firmly connected with the bony elements of the region over which they confine the muscles. An ample areolar tissue serves to connect the fasciæ with the structures they invest, and elastic tissue in considerable quantity exists in the connective medium. A muscle enjoys free movement within its sheath in the direction of its fibres.

If we examine muscles in different parts of the body, we observe that <sup>Variation in texture.</sup> they vary in texture so far as regards the smoothness, size, and length of the bundles of fibres. If we compare the delicate structure of the *transversalis abdominis*, or of the smaller muscles of the limbs with the coarser *triceps extensor brachii*, or *triceps abductor femoris*, a material difference may be noticed. The bundles of fibres characteristic of different muscles, are termed *fasciculi*.

The elementary fibres or *primitive bundles*—primitive fasciculi of <sup>Elementary fibres.</sup> Fontana—composing the larger bundles—vary much in thickness, and Mr Bowman states their average diameter in the human subject as  $\frac{1}{352}$ nd of an inch in the male, and  $\frac{1}{454}$ th in the female. In mammalia they vary from  $\frac{1}{1100}$ th to  $\frac{1}{192}$ nd, and average  $\frac{1}{581}$ st of an inch. Mr Bowman says that the varieties in the average bulk in different classes of animals have a close connection with differences of nutrition and of their irritability.

Diameter of primitive fascicula in various domestic animals in fractions of an English inch:—

Horse,	.	.	.	$\frac{1}{1100}$ th	to	$\frac{1}{508}$ th	of an inch.
Cow,	.	.	.	$\frac{1}{330}$ th	„	$\frac{1}{192}$ nd	„ „
Sheep,	.	.	.	$\frac{1}{610}$ th	„	$\frac{1}{520}$ th	„ „
Pig,	.	.	.	$\frac{1}{266}$ th			„ „
Cat,	.	.	.	$\frac{1}{1000}$ th	„	$\frac{1}{400}$ th	„ „
Rabbit,	.	.	.	$\frac{1}{620}$ th	„	$\frac{1}{307}$ th	„ „
Turkey,	.	.	.	$\frac{1}{700}$ th	„	$\frac{1}{350}$ th	„ „



The annexed drawing of a *primitive bundle* indicates the beautiful striæ characteristic of voluntary muscular tissue. They are well seen in any specimen of muscle placed under the microscope, and examined by transmitted light. Mr Bowman, who is a distinguished authority on this subject, first indicated that in tearing muscle with needles for the purposes of microscopic examination, a cleavage occurs along the dark lines separating the fibre into plates or discs; and it is evident, says Mr Bowman, that "there is a tendency in the mass of the fibre to separate, when torn or pulled after death, along the transverse planes, of which the dark transverse stripes are the edges.



Fig. 177.

When such a separation takes place, a series of discs result; but to say that the fibre is a mere pile of discs is incorrect, for the discs are only formed by its disintegration."

Fibrillæ.

Sharpey, Kölliker, and others agree in describing a fibre as made up of fibrillæ. Dr Martin of Bristol, in a paper "On the Anatomy of the Muscular Fibre,"\* says: "The fibres are fusiform, their ends varying a good deal, but most of them being extremely fine. This I mention incidentally, because, though discovered by Rollet in 1856,† it seems to have often escaped notice. Much variety is also observable amongst the fibres, some of which are more translucent than others. The broad, highly refracting fibres are in a more or less advanced state of fatty degeneration, and to such an extent is this the case in delicate white meat, that I have ultimately had recourse to the red and coarse fibres of more used muscles. If such a muscle be employed more opaque fibres are seen, and if, with very little fluid on the stage,



Fig. 178. — (TODD and BOWMAN.) — *a*, Muscular fibre represented breaking up transversely into discs; *b*, surface of one of these discs.

\* *Edinburgh Veterinary Review*, vol. iv. p. 338.

† *Ueber freie Enden quergestreifter Muskelfaden*. Sitzungsber d. Wiener Akad.

the needle points be inserted into one fibre after another, some will be found to split much more readily than the rest. The further dissection of these, when isolated, is by no means so difficult as is generally supposed. It requires a steady hand, a well-supported arm, and sharp needle-points. The quantity of fluid must be so small that the fibre lies still while being dissected, or all is useless. It is not enough to make button-hole openings in fibres, but every part must be split again, and detached ends turned back, so as to open all the angles. Allow then a wave of fresh fluid to spread over the whole, and bring the cover into position. In this way I rarely fail to discover fibrillæ which present all the material for further study. Under a power of 400 diameters, each fibrilla is seen to consist of a row of rectangular 'sarcous elements' between which there are clear spaces. Sarcous  
elements. If the power used be increased to 1,200 diameters, and the correction of the object-glass, which will be different from every fibrilla on the field, according to its depth in the fluid, carefully adjusted on Mr Wenham's plan, a series of totally new and important points come to light.\*

"The first thing to be noted is the extreme rarity of *single* fibrillæ, most of those so appearing under a power of 400 diameters, are now seen to be composed of bundles, oftenest of two, sometimes of more fibrillæ. Here and there a single undisturbed fibrilla is, however, seen. Rectangular sarcous elements, their longitudinal axes rather the longer, and between which a pale translucent material is interposed, lie in a regular series, the intervening spaces measuring less than half the length of each sarcous element. The next point is this, that instances occur (several, it may be, in a single specimen) of sarcous elements separated from each other by spaces which are *more than equal* to the length of each element, and this may be seen in fibres, pieces split from fibres, bundles of two or three fibrillæ, or lastly, in isolated fibrillæ. Close observation shows that this condition is due to stretching; and, in fact, all muscular tissue in fine microscopic shreds, is in one of the two definite conditions, stretched and unstretched. To explain and prove this, I have figured a fortunate example in which manipu-

\* It may be well to observe, at the risk of tedious minuteness, that if Goadby's fluid be employed, as by Mr Lealand, and the stratum chance to be thick, there are very few high angled objectives which will "correct" for so much refraction as then takes place.

lation has stretched an isolated double fibrilla; one-half has given way and curled up, the rest is tense, and shows a totally different structure. I have stated above that bundles of fibrillæ appear as single ones under 400 diameters, and now it will be understood how this may happen; a bundle of two or more being stretched, the apparently simple sarcous masses are elongated, the interposed spaces widened out, and the once broad bundle assumes the relative proportions of a single fibrilla. We may next observe, that in stretched fibres there appears a transverse line, which crosses the interposed matter half-way between the adjacent sarcous elements. This line is not seen in unstretched fibres, and can only be understood by examining it in a single, or, at most, double fibrilla, when it clearly appears as formed by a minute oblong mass, with its long axis at right angles to that of the fibres. In a double fibrilla, there are two such bodies side by side, and into these the interposed line may be resolved. In a fibrilla which is not stretched, we must of course believe this interposed particle to be present though concealed by the proximity of the sarcous elements."

Mr Bowman's  
opinion.

Referring to the ultimate fibrillæ, Mr Bowman has said that they "do not exist as such in the fibre, and to obtain them its structure must be broken up to a certain extent, for the union which naturally subsists between these parts must be destroyed. It is therefore most correct to say that there is an indication in the entire state of the fibre of *a longitudinal arrangement of its parts, occasioning a cleavage in that direction on the application of violence.*" Dr Martin writes with great significance on this point, and says: "The question of 'discs' as against 'fibrillæ,' is more interesting to the physiologist than might be supposed from the summary way in which most English, and polemical way in which most German, writers despatch it. The histology of muscle is far in advance of its physiology, and the latter science requires to deal with the subject in every possible aspect. Discs, to which Mr Bowman attached an importance, which all subsequent critics have been unable to destroy, have to my mind a deep physiological significance. During contraction of part of a fibre the transverse lines approximate, and so the discs (whether those of the sarcous particles or those of the interposed substance) can act as independent structures, which fibrillæ never do; a fibrilla, as such, does nothing. Add to this the almost obtrusive similarity of the whole structure to that of a voltaic pile, and it must be confessed that, though isolated discs and fibrillæ are the immediate results of

Dr Martin's  
opinion.



cleavage force, the existence, especially of the former, must never be left out of sight."



Fig. 179.—(BEALE.)—The extremities of two elementary muscular fibres, showing their connection with the tendon from the eye of the frog. The oval masses of germinal matter (considered by some to be nuclei, and by others as spaces), are seen both in the muscle and tendon. Those in the muscle are connected with the formation of the contractile tissue, while those in the tendon take part in its production.

The elements of muscle are joined together by an areolar tissue, *Sarcolemma*, which is continuous with the investing tube of the fleshy fibres, or sarcolemma. Schwann first described the latter structure in connection with the development of muscle in insects and fishes, and, independently, Bowman made similar observations in 1839. In the annexed



Fig. 180. Fragment of an elementary muscular fibre held together by the untorn but twisted sarcolemma.

engraving the presence of the sarcolemma is demonstrated in a muscular fibre broken across, and such a structure may also be seen wrinkled in muscle that has been steeped in spirit.

Schwann believed the sarcolemma to be a portion of the membrane of the original cells of development united to form a single tube; but it would seem to be a portion of the connective tissue of muscle, though, according to Dr Otto Deiters, it is to be classed along with the formations termed cuticular.

There is probably more direct connection between the nuclei, so much spoken of in the elementary mus-

its continuity with the tendons.

cular fibre in the foetus, as the development of the sarcolemma in this structure, like the nuclei, is less distinct in the best developed fibres, and the nuclei are certainly on the surface of the fibres and not in their interior.

The connection between the fleshy part of a muscle and its tendon has puzzled histologists much. For several years I have been in the habit of describing the direct continuity of tendons with the connective tissue of muscle, so that it is impossible to make out any abrupt termination of the one and commencement of the other,

as some have striven to explain. The continuity of the connective tissue within a muscle and the tendinous extremities is well seen in cases of atrophy, and I have seen instances in which, after paralysis of a muscle, (in cases of shoulder-slip in the horse), fat has become entirely substituted for the fibrillæ, and the connection between the tendon and the areolar tissue, which invests the ultimate fibres, could be satisfactorily seen.

Tendons.

The tendons are solid bundles of white fibrous tissue, which become flattened in their passage over bones and articulations. They are directly continuous with the animal basis of bony tissue, and are fixed in their course by bands of fibrous texture, which cross them, constituting *annular ligaments*. Sometimes a tendon is bound down by a muscle, as in the case of the extensor metacarpi magnus, which is held against the bone by the extensor metacarpi obliquus.

Thecæ and  
synovial  
membranes.

When two tendons are closely applied to each other, and must move independently, a synovial sheath or theca is formed, as seen with the flexors of the extremities. In their passage over bony prominences tendons are attached by lateral bundles to the latter, and their movements are facilitated by synovial sacs, such as may be seen on the trochlea of the humerus.

There are parts over which tendons glide, where their tissue becomes ossified, and by this means powerful levers are constructed. The bones thus formed are termed sesamoids, of which we have instances in the patella and the sesamoid bones, at the back of the fetlock joints.

Tendons become adapted to the surfaces of sesamoid bones and prominences. They acquire great toughness, and become fibro-cartilaginous where there is much friction, as where the flexor-pedis passes over the navicular bone.

Vascularity  
of muscles.

Muscles are very vascular. The blood-vessels are embedded in the areolar tissue, which acts as a matrix or basis in which they are protected and ramify. A rich network with rectangular meshes is produced by the splitting

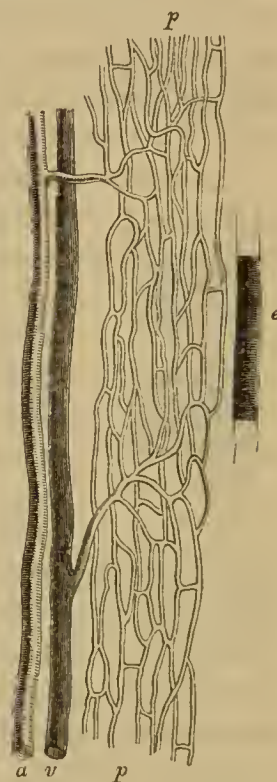


Fig. 181.—(TODD and BOWMAN.)—Distribution of blood-vessels in muscular tissue. *a*, Artery; *v*, Vein; *pp*, Capillary plexus; *e*, Elementary muscular fibre, to show the relative proportion.

up of the vessels in the direction of the fibres, and their anastomosing across the latter. The capillaries of muscle are very small, and their coats consist in a simple diaphanous membrane on which nuclei are seen.



Fig. 182.—(TODD and BOWMAN.)—Termination of a nerve in muscular tissue, after Burdach, showing the loops.

The nerves of muscle are also numerous, and split up to form very delicate plexuses on the surface of the sarcolemma, which they do not penetrate. Loops are seen formed by the ultimate nerve fibres in coalescing to constitute the intricate plexuses, which demand further study.

Nerves of muscles.

Lymphatic vessels are met with in the larger muscles—they have their usual plexiform arrangement, and considerable ones may be seen in company with the larger blood-vessels.

Lymphatics.

CHEMICAL CONSTITUTION OF MUSCLE.—One of the most interesting points to allude to under this head is the similarity in the constitution of flesh and blood. Playfair and Boeckmann have furnished us with the following comparison:—

	Flesh.	Blood.	Analyses of flesh and blood.
Carbon,	51.86	51.96	
Hydrogen,	7.58	7.25	
Nitrogen,	15.03	15.07	
Oxygen,	21.30	21.30	
Ashes,	4.23	4.42	

Berzelius found in 100 parts of fresh voluntary muscle of the ox—

Fibrin,	15.80
Gelatin,	1.90
Albumen, with colouring matter,	2.20
Alcoholic extractive, with salts,	1.80
Watery do. do	1.05
Phosphate of lime, with albumen,	0.08
Water and loss,	77.17

100.00

The fibrin of muscle has been named syntonin, which differs somewhat from the fibrin of blood. The extractive matters have been

Proximate principles of muscle.



divided into several important proximate principles, viz.:—kreatine, kreatinine, inosinic, lactic, acetic, butyric, and formic acids, with a peculiar form of sugar termed inosite. Kreatine is the product of waste during museular contraction, and is said to be found in greatest abundanee in the museles of animals hunted to death.

The colouring principles of muscles are, as stated before, the same as those of blood, and may be extracted by immersion in water.

Tenacity.

**PHYSICAL PROPERTIES OF MUSCLE.**—Muscle has a certain tenacity which, in the living state, far exceeds the resistance observed after death. By muscular contraction during life tendons are lacerated and bones broken, but after death the tendons resist more than the fleshy fibres. A good illustration of this is afforded by the diaphragm, which so frequently bursts in the horse when the intestines are distended by gas in the dead animal. The tendinous portion remains intact, but the fleshy fibres yield on comparatively slight pressure. Muscles are elastic. According to Kölliker, it is an increase of elasticity which occasions *rigor mortis* or cadaveric rigidity. This is a physical phenomenon, the muscle becoming hazy, opaque, and acid, whereas, so long as it retains its irritability, it is transparent and alkaline. It is believed by Kühne and others that the albuminous principles which compose muscle must be fluid, though in a state of concentrated solution in an irritable muscle, whereas they clot in a rigid one, and once clotted, putrefaction alone relieves the rigid state.

Rigor mortis.

**VITAL PROPERTIES OF MUSCLE.**—We shall not discuss here the very intricate physiological questions relating to muscular movement. We must, however, indicate what the vital properties of muscle are.

Sensibility.

*Firstly*, Muscle feels. Pain is felt if muscle is cut. This is due to nerves of sensation, and we must also attribute to the connection of the voluntary muscles with the nervous system the “muscular sense,” which must be distinguished from sensibility, in being the property whereby an animal is conscious of the condition of its voluntary muscles.

Muscular sense.

Muscular irritability.

*Secondly*, Under the influence of certain causes—stimuli—muscle shortens or contracts. The susceptibility to a stimulus is termed muscular irritability. Haller regarded this property as restricted to museular tissue, whereas others have considered it due to a property communicated by the nerves to muscle. This subject is one favourable to endless controversy, and this because nerves divide so freely in muscle that it is impossible to say when a stimulus is touching

simply muscular tissue or affecting the nerves within it. German experimenters have not been altogether baffled by this apparently insurmountable difficulty.

The stimuli which are capable of inducing muscular contractions have been divided into immediate and remote—the latter operate through the nerves, and the first directly on the muscular fibre. The stimuli have been classified into—*a*, mechanical; *b*, chemical; *c*, electrical; *d*, heat or cold; *e*, volitional; and, *f*, emotional. It is the chemical and electrical stimuli which physiologists have employed in attempting to solve the question as to the seat of muscular irritability. With chemical stimuli Kühne\* seems to have arrived at the conclusion, that it requires a more active stimulus to induce muscular contraction through the nerve than by directly touching the muscular fibre. The agents employed may be thus subdivided:—1. Those that affect the muscular section in a dilution greatly inferior to that in which they affect the nerve; of these hydrochloric and nitric acids may be taken as types. 2. Those that act on muscle in a concentration in which they no longer influence the nerve, as chloride of sodium, chloride of calcium, acetic acid, lactic acid, glycerine, and the biliary alkaloids. 3. Potash and soda affect the muscle and nerve about equally. A 4th class act violently on the muscle, and not at all on the nerve, as sulphate of copper, and particularly ammonia. A 5th series will excite through the nerve, but scarcely by direct contact with the muscle, as creosote, alcohol, concentrated glycerine, syrupy lactic acid. A last class may be said not to affect either organ sensibly, as the fatty oils and turpentine.

After paralysing the nerve of a muscle by means of electricity, or, in other words, getting the nerve in an anelectronic state, and then applying chemical stimuli to the muscular fibre, the latter responds to its appropriate stimuli.

*Thirdly*, Contractility, or the power to shorten, possessed by muscles, is manifested, according to some observers, in two conditions—in the state of *tonicity*, and of *active contraction*. Referring to the first, Kölliker says: "I do not admit the existence of the so-called *tonus* of the muscles, if by that term is understood a long continuing contraction, maintained without the influence of the will, although originally excited thereby; and I am of opinion, that what has been designated under this name, is, for the most part, only the elastic tension, which has been confounded with the antecedent contraction which it succeeds." On the other hand, Sharpey says of the "tonic

Classifica-  
tion of  
stimuli.

Muscular  
contracti-  
lity.

\* *Archives of Medicine*, vol. iii, p. 147.

state:"—"It is no doubt a species of contraction, as well as the more conspicuous and powerful action with which it may alternate; but it is employed merely to maintain equilibrium, not to cause motion, and it is not temporary but enduring, continuing during sleep, when volition is in abeyance, and occasioning no fatigue." We certainly incline to Kölliker's opinion, as we can understand *persistent tension*, but not *persistent action*, occasioning no fatigue.

Alternate contraction of fibres.

The property of contractility is manifested in the shortening and swelling of muscular fibre. In a contracting muscle some fibres are in a state of contractility, and others not. The latter have a peculiar zig-zag arrangement from being wrinkled. The contracted state of a muscle is maintained for some time by the alternate contractions of its constituent fibres.

A contracted muscle does not increase or diminish in bulk; it emits a sound—sussurrus—compared by Dr Wollaston to the distant noise of carriage wheels; it undergoes waste or chemical change, and it evolves heat and electricity.

Cessation of irritability.

The irritability of muscle ceases after death, and Nysten found that in the human body its extinction takes place in the following order:—1, the left ventricle of the heart; 2, the intestines and stomach; 3, the urinary bladder; 4, the right ventricle; in these generally within an hour; 5, the gullet; 6, the iris; 7, the voluntary muscles—*a*, of the trunk; *b*, of the lower, and *c*, of the upper, extremities; 8, the left auricle; and 9, the right auricle of the heart, which Galen styled "ultimum moriens."

#### POSITIONS GIVEN TO THE SUBJECT IN DISSECTION.

Lest the cadaveric rigidity should prove an impediment to dissection, it is important that, as soon as an animal is killed, it should be placed in a convenient position. Three principal positions have been recommended by Chauveau, and may be beneficially adopted.

First position.

1st. The first position is that in which the subject is placed on its back upon a table of convenient size. The limbs are extended by ropes fixed to the pasterns, and passed through rings in the summits of four iron pillars, which are fixed in the four corners of the table. These pillars may rise to the height of between four and five feet above the level of the table. The head of the subject is carried over the end of the table and supported on a stool, at a somewhat lower level, so that no twisting of the neck may occur. In this position may be dissected the inferior cervical, pectoral, and abdominal regions.



together with the anterior and internal femoral. After removing the abdominal viscera, the diaphragm and sub-lumbar regions may likewise be studied.

2nd. The subject is placed in the second position by turning it upon its belly, the hind limbs being extended behind the table, and the head supported by a rope passing beneath the jaws, and attached to the two posts at that end of the table. In this position may be dissected the superior cervical, external scapular, gluteal, and posterior and external femoral regions, as well as the muscles of the back, loins, and ear.

Second position.

3rd. In the third position the subject is simply turned upon its side. Before doing this, however, and supposing that the regions above indicated have been dissected, it will be rendered much less unwieldy by cutting through the lumbar region, so as to detach the posterior part of the body. From the latter the posterior extremities may be detached by sawing through the femur at its middle. The coccygeal muscles may now be dissected on the pelvic portion of the body, while the internal and external thoracic, the intercostals, and the remainder of the cervical muscles, may be prepared on the anterior part.

Third position.

The fore limbs may be removed and the head disarticulated for separate dissection.

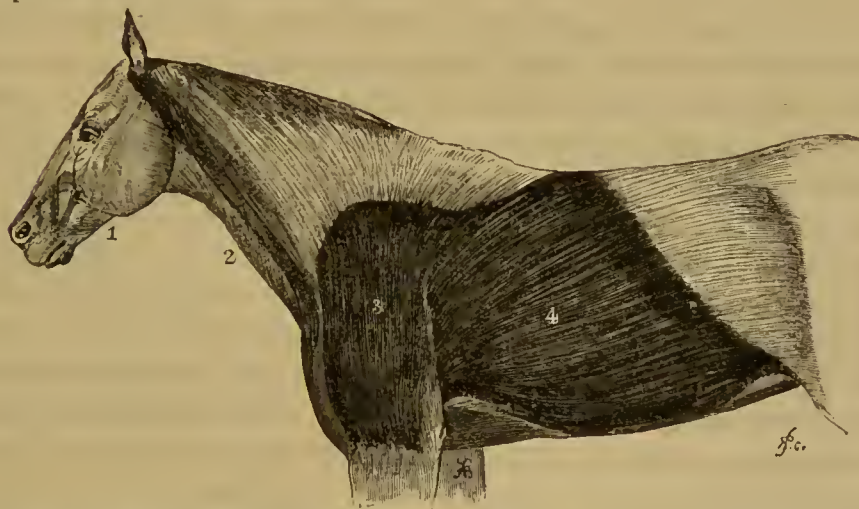


Fig. 133.—(Representing the Panniculus Carnosus).—1, Facial portion; 2, Cervical portion—fibres diverging from the median line inferiorly; 3, Perpendicular fibres over the shoulder; 4, Thoracic and abdominal portion.

#### SUBCUTANEOUS REGION.

This region comprises a single muscle, the *panniculus carnosus*, which is peculiar to quadrupeds. It covers all parts of the body not within range of other protecting agents, such as the tail or mane.

Only one cutaneous muscle.

*Dissection.*—Place the body upon its side, and dissect off the skin from the whole lateral parts of the trunk, care being taken that no muscular or aponeurotic structure be raised with the integument.

Divided into  
two parts.

*Panniculus Carnosus.*—The muscle may be conveniently divided into two portions, one covering the thorax and abdomen, the other lying on the neck and face.

Form is  
irregularly  
triangular.

*Abdominal and thoracic portion.*—This is a large flattened muscular mass, very thin at its margin, but thicker towards its middle part. Its form is very irregular, but approaches that of a triangle; the superior border is curved upwards, and extends from the withers to the stifle; the inferior extends from the stifle forwards to the elbow joint, a projecting angular portion stretches downwards upon the abdomen, and while on the thorax it covers, and is closely connected to, the superior border of the pectoralis magnus; the anterior border extends from the middle of the scapula down upon the fore-arm.

Direction of  
its fibres.

The fibres on the abdomen run obliquely from above downwards and forwards, becoming more perpendicular as they approach the shoulder; on the shoulder they assume a completely vertical direction. Its whole external surface adheres more or less intimately to the skin by which it is covered. Round its circumference it becomes continuous with an aponeurosis, which along the superior border unites with that of the dorsal muscles, and through this becomes connected with the spines of the dorsal and lumbar vertebræ; posteriorly it becomes continuous with the fascia covering the thigh; inferiorly it is firmly attached to the skin, and less so to the tunica abdominalis; anteriorly it is connected to the fascia of the cervical muscles and that of the arm. Just behind the shoulder it gives off a deep layer, which, running forwards in intimate relation with the pectoralis magnus, is attached to the internal tubercle on the head of the humerus. A slight aponeurotic slip likewise goes to the inner aspect of the latissimus dorsi. The superficial layer at the same point becomes tendinous, again assuming the fleshy form after an interval of little over an inch.

Attach-  
ments.

Deep layer;

its attach-  
ments.

Relations.

In intimate union with the skin throughout its whole external surface, this muscle responds internally to the dorsal trapezius, latissimus dorsi, serratus magnus, several intercostals, external oblique, abdominal tunic, spur vein, and the superficial muscles of the shoulder and arm.

Form.

*Cervical and facial portion.*—This part is in the form of a flat band on the lower part of the neck, joining its fellow in the median

line by a white fibrous raphé; below the angle of the jaw this union ends, and the muscular fibres, crossing the ramus of the jaw, become spread out on the lateral parts of the head.

*Originating* posteriorly from the cariniform cartilage, by a thin aponeurosis from the inner part of the head of the humerus, and from the median raphé, the fibres run obliquely upwards and forwards, becoming continuous with an aponeurosis, which extends to the ligamentum nuchæ, and is in close relation with the muscles of the superior cervical region. Superiorly some fibres expand on the parotido-auricularis, the remainder pass through the intermaxillary space and gain the side of the face, where they are partly inserted into the zygomatic crest and fascia of the masseter, and partly converge to the angle of the mouth, where they unite with the alveolo-labialis, the latter part being sometimes called the levator anguli oris.

Direction of fibres.  
Connection with the ligamentum nuchæ.

Insertions.

It is related externally to the skin, from which it is separated in the cervical part by a thin layer of areolar tissue, becoming more firmly attached on the face. Internally the cervical part lies over the sterno-maxillaris, sterno-thyro-hyoideus, subscapulo-hyoideus, and the jugular vein; the faecal part covers the parotido-auricularis and masseter.

Relations.

The panniculus, by virtue of its insertion on the skin, is capable of corrugating that covering, and by its violent action the animal can effectually dislodge insects and other irritants from the surface of the body. The cervical portion is so loosely connected with the skin that its cutaneous action is much diminished; its braeing of the cervical muscles may, however, favour their action.

Action of the panniculus.

*Differences.*—In the *ox* the abdomino-thoracic portion does not materially differ from that of the horse. The cervico-facial part is represented by an aponeurotic and a muscular layer. The aponeurosis is placed superficially over the muscles of the neck, to which it is internally connected. On reaching the posterior border of the lower jaw, it ends in muscular fibres, part of which proceed to the angle of the mouth, and become inserted on the alveolo-labialis, while the remainder go to join those of the opposite side in the median line of the intermaxillary space. The muscular portion is a somewhat thick band, placed under the aponeurosis, on the inferior aspect of the neck. It does not, like the panniculus of the horse, turn upwards to cover the levator humeri. It is attached posteriorly to the first segment of the sternum, and at the posterior border of the inferior maxillary bone, ends in a flattened tendon, which is con-

Peculiarity of the cervical portion in the ox.

Muscular band.



founded with the aponeurosis of the masseter towards the anterior border of that muscle. Some of its tendinous fibres go to the muscles of the face. In the *sheep* the aponeurotic layer alone exists.

Only aponeurotic in the sheep's neck.

Two cervical portions in the pig.

In the *pig* the cervical portion of the panniculus is composed of two parts, a superior and an inferior. The former arises from an aponeurosis connected with the spine of the scapula—the latter from the cariniform cartilage. These portions are united anteriorly, where they cover the facial muscles, and are inserted on the outer surface of the lower jaw as far forwards as its body.

Two layers on the neck of the dog.

Inferior layer.

In the *dog* the cervical panniculus is similarly divided into two portions, which correspond to those of the pig posteriorly, but are not confounded anteriorly. The inferior division, on reaching the posterior border of the lower jaw, spreads out in a radiating direction, some of its fibres entering the intermaxillary space, others covering the side of the face, and the remainder lying over the parotid gland, where it constitutes the parotido-auricularis. The superior portion is at once broader and thicker than the inferior. It covers the lateral aspect of the neck and face, and extends into the intermaxillary space, where it joins with the fibres of its fellow.

Superior layer.

Dorso-lumbar panniculus.

The *dorso-lumbar division* in this animal is extended upwards, so as to meet its fellow across the lumbar spines. It is likewise prolonged upon the gluteal region.

#### ABDOMINAL REGION.

The lateral and inferior walls of the abdomen are composed of muscular and fibrous tissues, which are attached by their circumference to the spine, the ribs, and the pelvis. Beneath the panniculus, on each of its lateral aspects, are three layers of muscles: the external, having its fibres directed obliquely downwards and backwards, is called the *external oblique*; the next has its fibres running obliquely downwards and forwards, and is called the *internal oblique*; while the deepest, the fibres of which proceed straight downwards, is called the *transverse muscle* of the abdomen. On its inferior part we meet externally with a covering of yellow elastic tissue, beneath which are the aponeuroses of the three muscles above mentioned, and between those of the two external and the internal, a muscle exists, the fibres of which run longitudinally from before backwards, the *rectus abdominis*. A white line running from the ensiform cartilage to the symphysis pubis, and formed by the union of the aponeuroses of the abdominal muscles, is called the *linea alba*.

Lateral walls.

Inferior walls.

*Dissection.*—In laying bare the superficial parts of these structures, an incision must be made through the skin along the median line of the abdomen, and another, carried from its median part up to the spine; the two flaps thus made are to be raised until the whole abdomen, and the lower and posterior half of the thorax, has been exposed. The panniculus carnosus is then to be removed, and the various coverings successively examined.

*Tunica abdominalis.*—The yellow elastic covering which invests Its position. the lower part of the abdomen is so named.

Towards its origin from the pubic symphysis, where it covers the Thickest in front of the pubis. thick fibrous band attaching the abdominal muscles, it is of considerable thickness; the same remark applies with nearly equal force to that part running along the side of the posterior half of the *linea alba*; anteriorly, however, it becomes thinner, and entirely disappears towards the posterior border of the pectoralis magnus. Laterally it becomes gradually thinner, and after passing over the lower part of the muscular division of the external oblique, becomes completely lost on its surface; at its anterior part, it extends over the four last digitations of the serratus magnus. Posteriorly, a thin prolongation goes to the inner side of the thigh, and expands on the adductor muscles.

By its external surface the tunic is related to the panniculus and Relations. skin, giving attachment posteriorly to the dartos and suspensory ligaments of the sheath in the male, and to the yellow elastic capsule of the mammæ in the female. At various parts are small openings for the transmission of vessels and nerves to the skin. The internal surface is almost entirely related to the external oblique, the inferior part being firmly attached to its tendon, and the superior less closely, but still very intimately, to the muscular part.

This covering acts as a great elastic bandage for the support of the Use. abdominal organs, and by its very intimate relation to the whole of the aponeuroses of the oblique muscles, tends greatly to relieve those structures from the tension which their position necessarily entails upon them. Its thickness increases with the increased bulk of Increases with size of abdomen. the abdominal organs, as is very noticeable in the case of pregnant mares.

In the *dog*, *cat*, and *pig*, the abdomens of which are relatively less Very thin in carnivora. bulky, it is reduced to a thin membrane only.

*Linea alba.*—The linea alba, as already noticed, extends from the Position. inferior part of the ensiform cartilage, to which it is firmly attached, Attachments. as far as the symphysis pubis, on the anterior part of which it is inserted, along with the accumulated aponeuroses of the oblique, and

transversalis muscles. Immediately in front of the pubis it joins the aponeuroses just named, to form a powerful tendon—the *prepubian*. This tendon limits the inguinal ring internally, and at its pubic attachment gives origin to the pubio-femoral ligament. Towards the middle of the linea alba the fibres diverge so as to form a lozenge-shaped space, in the centre of which is a trace of the umbilical opening.

*Dissection.*—To expose the external oblique, carefully remove the abdominal tunic, raise and turn forwards the abdominal prolongation of the pectoralis magnus, and dissect off the sheath and dartos in the male—the mammæ in the female.

*Obliquus externus abdominis* (external oblique; costo-abdominalis, Gir.)—(Fig. 176, No. 23.)—This muscle, which is the largest and most superficial of those covering the abdomen, occupies the infero-lateral aspect of that cavity, and is composed of two portions, a muscular and an aponeurotic.

The *upper* or *muscular portion* is in the form of a broad flattened band, becoming narrower and thicker towards its anterior extremity, where it covers the lower third of the thirteen last ribs. The superior margin is attached in its anterior half to the posterior borders of the fourteen last ribs, by partially tendinous serrations; the anterior four serrations digitate with the serratus magnus, some fibres of which become inserted on the aponeurosis of the former. The posterior part of the upper margin is attached to the fascia of the latissimus dorsi. Some of the posterior fibres run nearly horizontally backwards to be inserted on the external angle of the ilium, while the great majority run downwards and backwards, to terminate in the aponeuroses below the cartilages of the false ribs.

The *aponeurosis*, like the muscular portion, is narrow in front, and broad behind. Bounded superiorly by a waving line, along which it is continuous with the muscular part, it is inserted inferiorly on the whole linea alba and the symphysis pubis. The posterior border, comprised between the external angle of the ilium and the symphysis pubis, is in the form of a flat band, which, dividing into two, sends one fold down upon the internal aspect of the thigh to unite with the fascia lata, while the other turns upwards and forwards, constituting that part known as *Poupart's ligament*. Towards the pubis, and immediately before dividing into two folds, it is pierced by a large oval opening—the *external abdominal ring*.

The external oblique is covered by the pectoralis magnus and



tnnlea abdominalis, the last of which separates it from the panniculus and skin. It is related internally to the ribs which give it attachment, to their cartilages, to the corresponding intercostals, to the internal oblique, and to the rectus abdominis.

*Poupart's ligament.*—As already mentioned, this is a dependence of the aponeurosis of the external oblique, turned upwards and forwards on the inferior aspect of the sartorius, pectineus, psoas magnus, and iliacus. It is a broad, flat band, attached by its extremities—superior and inferior—on the external angle of the ilium and anterior border of the pubis. It responds by the external portion of its posterior border to the above-mentioned muscles, and by its internal portion to the femoral vessels; the latter part (that inside the insertion of the psoas parvus) forms the anterior wall of a triangular orifice—*femoral or crural arch*—the two other borders of which are formed by the anterior border of the pubis, the iliacus, and sartorius. Through this arch the femoral vessels leave the abdomen.

Poupart's  
ligament.  
Situation.

Form and  
attachment.

Posterior  
aspect.

Femoral  
arch.

The anterior aspect of this ligament forms the posterior wall of the inguinal canal, and towards its outer extremity gives insertion to some fibres of the internal oblique. Its lower border is continuous with the aponeurosis of the external oblique, while its superior border, which is very much attenuated, unites with the lumbo-iliac fascia and that covering the sartorius.

Anterior  
aspect.

Borders.

*Inguinal canal.*—This is an infundibuliform canal piercing the abdominal walls immediately in front of the anterior border of the pubis. This canal, which is formed by Poupart's ligament posteriorly, and by the fleshy portion of the internal oblique, and the aponeuroses of the external oblique and transversalis anteriorly, is from two to two-and-a-half inches in length, and slightly compressed from before backwards. It gives exit to the spermatic cord and scrotal artery in the male, and to the mammary artery in the female.

Form and  
position.  
Structures  
composing  
it.

Its length.

Organs con-  
tained.

Its *external orifice* (*external abdominal or inguinal ring*), much larger than the internal, has an oval outline, and is bounded anteriorly and posteriorly by the condensed aponeurosis of the external oblique. These two borders or lips have been called the *pillars of the external abdominal ring*. The prepubian tendon limits the ring at its internal extremity, and the fascia of the external, and muscular body of the internal oblique muscles, at its outer extremity.

External  
abdominal  
ring.

Its pillars.

The *superior orifice* (*internal abdominal or inguinal ring*) is a simple dilatable opening, comprised, like the canal itself, between Poupart's ligament and the muscular body of the internal oblique.

Internal  
abdominal  
ring.



Fig. 184.—MUSCLES OF THE TRUNK — DEEP LAYER.

- |                                       |                                    |                        |
|---------------------------------------|------------------------------------|------------------------|
| 1. Complexus.                         | 8. Lateralis sterni.               | 16. Iliacus.           |
| 2. Trachelo-mastoideus.               | 9. Longissimus dorsi.              | 17. Gluteus internus.  |
| 3. Obliquus capitis anticus.          | 9'. Superior division of the same. | 18. Vastus externus.   |
| 4. Obliquus capitis posticus.         | 10. Ilio-costalis.                 | 19. Rectus femoris.    |
| 5. Longus colli.                      | 11. Psoas-magnus.                  | 20. Gastrocnemius.     |
| 6. Scalenus.                          | 12. Retractor costae.              | 21. Levator coccygis.  |
| 6'. Insertion of the serratus magnus. | 13. Internal oblique.              | 22. Ischio coccygis.   |
| 7. Internal intercostals.             | 14. Transversalis abdominis.       | 23. Quadratus femoris. |
|                                       | 15. Rectus abdominis.              |                        |

Not being surrounded by firm unyielding walls, the extremities of the internal ring are somewhat badly defined.

*Differences.*—In the other domestic mammals there can scarcely be said to be a prolongation of aponeurosis on the internal aspect of the thigh. In *carnivora* the muscular portion of the external oblique extends far down on the abdomen, so that its aponeurosis is comparatively short. External oblique large in dog.

*Dissection.*—Cut through the external oblique below its muscular portion, and reflect both that and the aponeurosis until the latter becomes intimately blended with that of the following muscle.

*Internal oblique*, (obliquus internus abdominis; ilio-abdominalis, Gir.)—(Fig. 184, No. 13.)—This muscle is externally covered by that last mentioned, and, like it, is made up of a muscular and an aponeurotic portion, the latter in this case being the more anterior. Situation and structure.

The *muscular part*, thick and fan-shaped, radiates from the superior fourth of Poupart's ligament, and the anterior spine of the ileum, to be distributed as follows:—The fibres from Poupart's ligament run downwards and inwards, becoming, however, separated from it towards its inner portion to form the anterior wall of the inguinal canal; its posterior border is in intimate relation to the cremaster, into the substance of which it sends some fibres. The inferior fibres from the anterior spine of the ilium, run backwards and inwards, the median downwards and inwards, while the superior run forwards, some being inclined slightly upwards to reach the posterior border of the last rib. Its superior border is united to the fascia of the latissimus dorsi, and some bundles of muscular fibres, through a band of yellow elastic tissue; its anterior, below the part joining the posterior border of the last rib, becomes continuous with the aponeurosis. Muscular portion. Origin. Fibres radiate.

The aponeurotic portion, the fibres of which run in exactly the same directions as the muscular fibres which they prolong, cross those of the external oblique, gaining insertion throughout the whole length of the linea alba, and anteriorly send some bands to the inner surface of the cartilages of the last false ribs. Aponeurotic portion. Insertion.

While covered by the external oblique above, inferiorly the tendons of the two oblique muscles become confounded together, crossing each other and interlacing so as to be practically inseparable. Its internal surface responds to the transversalis and rectus. Relations.

A few muscular bundles, originating from the extremities of several of the lumbar transverse processes, and inserted upon the Retractor costarum.



posterior border of the last rib towards the superior part, have been described as a separate muscle (retractor costæ) by the German veterinarians, but is more conveniently considered as a part of the internal oblique, to the superior border of which it is closely attached by yellow elastic tissue.

Oblique is  
very muscu-  
lar in rumi-  
nants.

*Differences.*—In *ruminants*, the muscular portion of the internal oblique fills up the whole space intervening between the anterior spine of the ilium, the posterior border of the last rib, and the lumbar transverse processes. The small retractor of the last rib has become completely fused with the mass of the muscle. In *carnivora* a similar union exists, and the fibres, instead of radiating, run parallel to each other from above downwards and forwards. In these animals, too, it is inserted on the posterior border of the four last ribs, about their middle.

*Dissection.*—In preparing the rectus abdominis, separate the common aponeurosis of the oblique muscles from the linea alba by a longitudinal incision; next by a transverse incision, carried from the umbilicus to the middle of the lumbar region, divide the muscular and tendinous parts of the internal oblique, and carefully dissect off the two flaps thus obtained, laying the one upon the thigh, the other upon the ribs.

Form and  
situation.

Structure.

Lineæ trans-  
versæ.

Posterior  
attachment.  
Anterior at-  
tachments.

Relations.

*Rectus abdominis*, (straight muscle of the abdomen; sterno-pubialis, Gir.)—(Fig. 184, No. 15.)—This is a long, narrow, and flat muscle, placed on the inferior part of the abdomen, and separated from that on the opposite side by the linea alba, to which it is intimately related. It presents the greatest breadth at its median part, and is marked throughout by transverse, zigzag intersections, caused by the muscular fibres resolving themselves into tendons at short intervals. These lines, which correspond to the lineæ transversæ in man, send interlacing fibres into the aponeurosis of the oblique muscles, which accordingly require to be cut before they can be separated. The lines are closer to each other, and better defined anteriorly than posteriorly.

It is attached posteriorly by the prepubian tendon to the symphysis and anterior border of the pubis; anteriorly to the cartilages of the six last sternal and of the first asternal rib, also to the inferior surface of the sternum.

Its inferior surface is in relation with the pectoralis magnus and the external oblique anteriorly, and with the aponeurosis of the oblique muscles posteriorly. Its superior surface lies on the fascia of the transversalis, the ensiform cartilage, and several costal cartilages.

*Differences.*—In *ruminants*, the transverse intersections are best marked on the superior surface. In the *carnivora* they are less marked than in other animals.

*Transversalis abdominis.*—(Fig. 184, No. 14.)—This muscle, covering the whole lateral and inferior aspects of the abdomen, is the Situation. deepest of the four abdominal muscles; those above described must, accordingly, be removed before it can be studied. It is a broad, flattened muscle, and, like the oblique muscles of the abdomen, is Division. composed of a superior muscular and an inferior aponeurotic portion.

The *muscular portion* is a flattened band, extending from the Muscular part; its form, etc. sternum along the course of the cartilages of the false ribs to the transverse processes of the last lumbar vertebræ. Its breadth in- Origin. creases gradually, from before backwards. The fibres run directly downwards to the aponeurosis. Its superior border is attached to the lower ends of all the false ribs on their inner aspect, close to the insertions of the diaphragm, and, by thin fascia, to the transverse processes of the lumbar vertebræ at their extremities. The lower border, which is convex, is continuous with the aponeurotic portion.

The *aponeurotic portion* is narrow and strong anteriorly, but be- Aponeurosis; its form. comes gradually broader and thinner in a posterior direction. Its fibres run directly downwards and inwards to the linea alba. Continuous, at its superior border, with the muscular portion, its inferior border is inserted on the ensiform cartilage, the whole linea alba, Insertion. and, by some fibres, on Poupart's ligament.

The external aspect of the transversalis is related to the cartilages Relations. of the false ribs, the rectus, obliquus internus abdominis, and the inferior branches of the lumbar nerves. Its internal aspect responds to the peritoneum, from which it is separated by an extremely thin fibrous layer (fascia transversalis), which in man and some animals becomes thicker towards Poupart's ligament, to which it becomes attached.

*Differences.*—In *ruminants*, the aponeurosis of this muscle is much thicker than in solipedes.

*Actions of the abdominal muscles.*—The thorax and pelvis being fixed points, the contraction of the abdominal muscles simultaneously with the diaphragm, will compress the abdominal viscera, as in the expulsion of urine or fæces, or in parturition. By a similar contrac- Actions of abdominal muscles on viscera. tion with a relaxed condition of the diaphragm, they prove expiratory muscles; this action is especially powerful when the vertebral column is fixed, as then they likewise act as depressors of the last ribs. In On thorax.

eases in which the vertebral column is not fixed, these muscles, and especially the rectus, flex the loins, and approach the pelvis towards the thorax.

#### SUPERIOR DORSO-LUMBAR REGION.

Contains eight muscles on each side.

Arranged in five layers.

Eight pairs of muscles exist in this region, filling up the angle formed on each side between the dorso-lumbar spines and the angles of the ribs. These muscles are arranged in five layers, in the following order—commencing with the most superficial: 1st, the *dorsal trapezius*, and *latissimus dorsi*; 2nd, the *rhomboideus posticus*; 3rd, the *serrati parvi anterior* and *posterior*; 4th, the *longissimus dorsi*; and 5th, the *ilio-costalis*, and the *semispinalis dorsi et lumborum*.

*Dissection*.—1st, place the subject in the second position; 2nd, remove the skin and panniculus from the whole dorso-lumbar region, after which raise the muscles, which take their inferior insertion into the olecranon, when the superficial layer will be exposed.

#### FIRST LAYER OF DORSAL MUSCLES.

*Dorsal trapezius*, (dorso-acromion, Girard; inferior portion of the trapezius in man).—(Fig. 176, No. 12.)—This is a flattened, triangular muscle placed above the shoulder, upon the side of the withers, and the fibres of which run from above obliquely downwards and forwards. It is aponeurotic towards its superior and anterior borders, but fleshy inferiorly.

*Form; position.* This muscle *originates* from the apices of the dorsal spines from the third to the eleventh, where its posterior border becomes confounded with, and is continued by, the aponeurosis of the latissimus dorsi.—Anteriorly, its aponeurosis is blended with the posterior border of the cervical trapezius, and both become *inserted* on the tubercle on the spine of the scapula.

*Direction.* It is related externally to the skin, from which it is separated, however, by a thin yellow fascia continuous with the panniculus. Internally it covers the rhomboideus posterior, and the upper half of the postea spinatus, but is separated from the former by the fascia of the latissimus dorsi. It also covers the cartilage of the scapula.

*Structure.* The trapezius acts on the scapula by pulling it upwards and backwards, and by approximating its upper half to the side of the chest.

*Relations.* It is related externally to the skin, from which it is separated, however, by a thin yellow fascia continuous with the panniculus. Internally it covers the rhomboideus posterior, and the upper half of the postea spinatus, but is separated from the former by the fascia of the latissimus dorsi. It also covers the cartilage of the scapula.

*Action.* The trapezius acts on the scapula by pulling it upwards and backwards, and by approximating its upper half to the side of the chest.

*Differences.*—In *ruminants* the trapezius is longer, but narrower than in the horse.



In the *pig* it is broad and thick, and takes its origin from nearly all the dorsal vertebræ. Larger in pig.

In the *dog* it is comparatively larger than in the horse, originates from the second to the seventh dorsal spines, and inferiorly gives off a fleshy band, which takes insertion on the inner aspect of the humerus, along with the latissimus dorsi. Additional fleshy band in the dog.

*Latissimus dorsi* (dorso-humeralis, Gir.)—(Fig. 176, No. 13.)—This muscle, as its name indicates, is of great size. Broad, flattened, and triangular, it is placed behind and rather below the last muscle, covering the whole of the loins and the greater part of the dorsal and costal regions. It is composed of a posterior, aponeurotic, and an anterior muscular portion. Form and position.

The *aponeurotic portion* takes its origin from the summits of the whole of the lumbar and the four or five last dorsal spines, also from the aponeurosis of the gluteus medius, and of the upper part of the oblique abdominal muscles. On a level with the cartilage of the scapula, it becomes muscular, commencing at the twelfth or thirteenth rib; the fibres run forwards and downwards, converge and end in a flattened tendon, which takes its *insertion* on the postero-internal aspect of the humerus, between the insertions of the bifid coraco-humeralis. This tendon is also common to the teres internus. Aponeurosis; its origin.

Covered externally by the skin and panniculus carnosus posteriorly, and to a small extent by the dorsal trapezius and extensors of the fore-arm anteriorly, the latissimus dorsi covers in turn part of the postea spinatus, the cartilage of the scapula, the rhomboideus posterior, the anterior and posterior small serrated muscles of the back, with the aponeurosis of which it is blended previous to taking its insertion on the spine, the longissimus dorsi, the gluteus medius, part of the oblique muscles of the abdomen, the last rib to which its fascia adheres somewhat firmly, several of the posterior intercostals, and the serratus magnus. Muscular portion.

When the muscle contracts the humerus is carried upwards and backwards, the limb at the same time undergoing a slight rotation inwards. It is actively employed in progression. From its loose connexion with the last rib, some consider it as an inspiratory muscle. Insertion.

*Differences.*—In *ruminants* this muscle is relatively considerably smaller. In the *pig* and *dog*, on the other hand, it is largely developed, and takes insertion by fleshy digitations on four or five of the ribs which it covers, so that it is truly a respiratory muscle. In the Relations.

Action.  
Small in ruminants.  
Is a muscle of respiration in the dog and pig.

same animals it becomes attached to the internal tubercle of the head, and the lip of the bicipital groove, of the humerus.

## SECOND LAYER.

*Dissection.*—Make a section of the trapezius at its middle part, and reflect its parts; do the same by the anterior portion of the aponeurosis of the latissimus dorsi, and the rhomboideus will be exposed.

Form and situation.	<i>Rhomboideus posterior</i> , (dorso subscapularis, Gir.; rhomboideus brevis, Per.)—This is a flattened quadrilateral muscle, situated upon the side of the withers, beneath the dorsal trapezius and the cartilage of the scapula. It is formed almost entirely of muscular fibres, which run parallel to each other, from its origin to its insertion.
Structure.	
Origin.	It arises from the summits of the second, third, fourth, fifth, and
Insertion.	sometimes the sixth dorsal spines, and is <i>inserted</i> on the inner aspect of the cartilage of the scapula.
Relations.	Responding externally to the trapezius and scapular cartilage, the rhomboideus brevis is related by its internal aspect to a thick layer of yellow elastic tissue, which covers the aponeurosis of the anterior small serrated muscle of the back. This elastic membrane, which is intimately adherent to the structures between which it is interposed, is continued forwards over the tendinous aponeurosis of the splenius and complexus muscles, and by several prolongations into the substance of the serratus magnus.
Action.	This muscle elevates the shoulder, and adducts the cartilage of the scapula.

## THIRD LAYER.

*Dissection.*—To expose the third layer, the anterior limb must be removed, together with the rhomboideus posterior and latissimus dorsi.

Form and position.	<i>Serratus parvus anticus</i> , (dorso-costalis, Gir.; anterior portion of the serratus longus, Bourgelat; superficialis-costarum, Percivall).—This is a thin, flat, quadrilateral muscle, situated beneath the rhomboideus brevis and the latissimus dorsi. It is aponeurotic at its origin, and fleshy at its insertion. The aponeurotic portion has its anterior border continuous with the fascia of the splenius; its posterior border insinuates itself beneath the aponeurosis of the posterior small serratus with which it is confounded. It becomes muscular on a level with the outer border of the longissimus dorsi, and is terminated inferiorly by a series of digitations. The fibres run in a direction from above downwards and backwards.
Structure.	
Aponeurosis.	
Muscular part.	
Direction of its fibres.	

It takes its *origin* by the superior border of its aponeurosis upon the summits of the dorsal spines, from the second to the thirteenth inclusive. It is *inserted* by a corresponding number of fleshy serrations, upon the anterior borders of the fifth and eighth succeeding ribs, between their upper and middle third. A small fibrous membrane leaves the inner aspect of the aponeurotic part, penetrates between the longissimus dorsi and the ilio-costalis, and takes insertion on the outer aspect of the above-mentioned ribs.

Origin.

Insertions.

Complimentary fibrous layer.

Its external surface responds to the rhomboideus posterior, serratus magnus, latissimus dorsi, and the small posterior serratus which covers its three last digitations; its internal surface is in relation with the longissimus dorsi, the ilio-costalis, and the external intercostals.

Relations.

This muscle is a true inspirator, but it is likewise useful in bracing the deeper-seated muscles of the back.

Action.

*Serratus parvus posticus*, (lumbo-costalis, Gir.; posterior portion of the serratus longus of Bourgelat; superficialis costarum, Percivall). —(Fig. 176, No. 22.)—This muscle is placed behind, and partially above that last described, and, like it, is composed of a superior aponeurotic portion, with an inferior muscular part, of a deep red colour, and terminating by eight or nine digitations. The muscular fibres run from above downwards, and slightly forwards, crossing the direction of those belonging to the anterior small serratus. The aponeurotic portion *originates* from the apices of the eight last dorsal, and the two or three first lumbar spines, and is intimately adherent to the aponeurosis of the latissimus dorsi. The nine digitations are *attached* inferiorly on the outer aspect of the nine last ribs.

Position.

Structure.

Direction.

Origin of aponeurosis.

Insertion.

Its whole external surface, except the two or three last digitations, responds to the latissimus dorsi, the serrations excepted, being commonly more or less covered by those of the external oblique of the abdomen. Internally it lies in contact with the three last digitations of the anterior small serratus, the longissimus dorsi, the ilio-costalis, and the external intercostals.

Relations.

This muscle acts in expiration by pulling the ribs backwards, and diminishing the cavity of the thorax.

Is an expirator.

*Differences in the small serrati of the back.*—In ruminants the anterior does not take its inferior insertion farther back than the ninth rib, and the posterior has only four digitations for the four last ribs, so that the digitations do not cross each other.

Small serrati do not overlap in the ox.



Carnivora  
have the  
anterior  
serratus  
large.

In *carnivora* the anterior is largely developed, and extends from the first six dorsal spines and the aponeurosis of the splenius to the third and seven following ribs. The posterior has three digitations only, which are inserted on the three last ribs.

#### FOURTH LAYER.

*Dissection.*—By raising the anterior part of the gluteus medius, and the two muscles of the third layer, the greater part of the longissimus dorsi is brought into view. To expose its anterior part, it is necessary to remove the cervical portion of the serratus magnus, the splenius, and the complexus, the insertions of the latter on the transverse processes of the dorsal vertebræ being preserved, that its relations to the longissimus dorsi may be studied.

*Longissimus dorsi*, (longissimus dorsi, transversalis cervicis, spinalis dorsi, semispinalis dorsi, and semispinalis colli, of Cuvier; longissimus dorsi, and transversalis cervicis of man).—(Fig. 184, Nos. 9, 9', 10.)—This great muscular mass, which fills up the furrow on the lateral aspect of the lumbar, dorsal, and posterior cervical spines, is at once the largest and the most powerful and complex muscle in the body.

Situation.  
  
Form of posterior extremity;

of anterior extremity.

Relations to complexus.

Attachments:  
on the pelvis;  
in the loins;

in the back;

in the neck.

Structure of the posterior portion

Fibres are inserted into and arise from the same point.

It is elongated from behind forwards, and in its posterior half forms a *single* undivided prismatic mass, flattened from above downwards, and deepest at its internal part: its anterior half bifurcates so as to form a superior and an inferior division, each of considerable size, and flattened from side to side. Between these parts the complexus passes to gain the transverse processes of the dorsal vertebræ.

It is attached successively, from behind forwards: 1st, upon the anterior border, internal angle, and part of the venter of the ilium, the sacro-iliac ligament, and the lateral aspect of the sacrum; 2nd, to the superior aspect of the transverse, the articular, and the summits of the spinous processes of the lumbar vertebræ; 3rd, to the spinous and transverse processes of all the dorsal vertebræ, and by small slips to the superior part of the fifteen or sixteen last ribs; 4th, by its superior division upon the spinous and articulating processes, and by its inferior part to the transverse processes of the four last cervical vertebræ.

Posteriorly, this muscle is composed of a bulky mass of muscular fibres, covered by a strong aponeurosis, common to this muscle and the gluteus medius, and giving direct insertion to the muscular fibres of each. In their forward course the muscular fibres take insertion upon the various osseous prominences in their tract, but from the

same points, as well as from the dense aponeurosis, other fibres are continually originating, so that the bulk of the muscle is continued throughout.

Anteriorly, the superior division is composed of muscular bundles, which are distinctly separable from those of the inferior division, as far back as the sixth dorsal vertebra. Behind this they become inseparably united to those of the inferior part through a strong fibrous interseetion. Its fibres run forwards and inwards to the spinous processes. The inferior division may be further distinguished, by the direction of its fibres, into two portions, an internal or deep, and an external or superficial. The deep portion is very tendinous, by which character, as well as by the loose connection between its bundles and those of the other parts, it may be traced back to its points of origin, from the dorsal, transverse, and the lumbar articulating processes. In front of the sixth dorsal vertebræ it becomes more superficial, sends some fibres into the two other parts, and takes its insertion on the transverse processes of the cervical vertebræ, leaving between it and the superior portion a space for the reception of the complexus. The superficial portion formed by fibres obtained from the two parts already noticed, has its fibres directed outwards to take insertion on the transverse processes of the dorsal vertebræ and heads of the ribs.

The longissimus dorsi is related externally in the dorso-lumbar region to the anterior prolongation of the glutens medius, to the common aponeurosis of the small serrated muscles of the back and of the latissimus dorsi; in the cervical region to the complexus, the splenius, and the cervical portion of the serratus magnus. It covers in turn the intertransversales lumborum, the semispinales dorsi et lumborum, the supra-costales, and the intercostales externi; also, in the neck, the ligamentum nuchæ, some intertransversales colli, and the insertions of the complexus on the dorsal transverse processes. Several fleshy bundles of the last-named muscle become continuous with those of the longissimus dorsi.

By acting upon the superior aspect of the vertebral column this muscle proves a powerful extensor of the back.

*Differences.*—In *ruminants* this muscle is interseetted by many more tendinous bands, but these are individually much smaller than those of the horse.

In the *pig* and *dog* the superficial part of the lower division is easily separable into two portions, the one formed by the fibres in-

Anterior  
portion.  
Superior  
division.

Inferior  
division.

Its deep  
fibres.

Its external  
and super-  
ficial fibres.

Relations.

Action.

Very tendi-  
ous in cattle.

More divi-  
ded ante-  
riorly in the  
dog.

	serted on the transverse processes, the other by those taking insertion on the ribs. The last part becomes attached to the heads of the five last ribs by its mass, and to those in front of this by small glistening tendons. This too is the part responding to the transversalis colli of man.
Very large in rabbits.	In <i>rabbits</i> and other leaping animals this muscle is enormously developed, more especially in the lumbar region.
Form and position.	<i>Ilio-costalis</i> (trachelo-costalis, Gir.; transversales costarum, Per.; intercostalis communis, Chavean).—(Fig. 184, No. 10.)—This is a long, thin, muscular band, placed along the external border of the last, and confounded with it behind the last rib.
Origin.	<i>Originating</i> posteriorly, along with the longissimus dorsi, from the anterior border of the ilium, and the transverse processes of the lumbar vertebræ, this muscle extends over all the ribs, just below their tubercles.
Structure.	It is partially divisible into a number of small muscular bundles, originating from the slips given off by the longissimus dorsi, strengthened by muscular bundles given off by the outer aspect of each rib, and terminating in a number of small flattened tendons
Insertion.	which run downwards, forwards, and outwards, to be <i>inserted</i> on each of the ribs at a lower part of their external surface: the last tendon is attached to the transverse process of the seventh cervical vertebra.
Relations.	It responds externally to the small serrated muscles of the back, and to the serratus magnus; internally to the external intercostals.
Action.	This muscle depresses the ribs, and assists in extending the dorsal region of the spine.
Larger and more distinct in the dog.	<i>Differences</i> .—In the <i>carnivora</i> this muscle has a closer resemblance to the sacro-lumbalis of man. It forms a considerable fleshy belly, quite distinct from the longissimus dorsi behind the last rib, and attached with that muscle to the ilium. Its lower insertions on the five last ribs are without the intervention of tendons.

## FIFTH LAYER.

*Dissection*.—In order to expose the fifth layer, the longissimus dorsi must be carefully raised from its attachments to the spinous and transverse processes of the vertebræ, and laid down upon the ribs; in connexion with this the internal angle of the ilium should also be sawn through and turned down.

Situation.	<i>Semispinalis dorsi et lumborum</i> , (transverso-spineux, Gir.)—This muscle is placed on the lateral aspect of the sacral, lumbar, and dorsal spines, under the longissimus dorsi. It is a long muscle, flattened from without inwards, thickly intersected with tendon, and having its fibres running in a direction upwards, forwards, and
Form and structure.	



slightly inwards, so as to cross the spinous processes nearly at right angles.

The muscular bundles take their *origin* from the lateral border of the sacrum, the inferior sacro-iliae ligament, the articular processes of the lumbar, and the transverse processes of the dorsal vertebræ. They are *inserted* on the spinous processes of the sacral, lumbar, and dorsal vertebræ, also on the last cervical. The slips are attached to the summits of all the vertebræ, except the first nine dorsal, where, though not reaching the summit, they are still longer than in the other parts of the muscle.

It is in relation with the longissimus dorsi, and the sacro-coccygeus lateralis externally, and the sacral, lumbar, and dorsal spines, with their interspinous ligaments internally.

This muscle acts like the longissimus dorsi, as an extensor of the back.

*Differences.*—In *ruminants* there is less tendinous material in the structure of this muscle. In *carnivora* it is remarkable for its greater breadth, its more muscular character, and its extension backwards, as far as the coccygeal vertebræ.

More muscular in the cow.  
Very large in the dog.

#### SUBLUMBAR REGION.

The sublumbar region contains eight muscles on each side, which may be enumerated as follows: psoas magnus, psoas parvus, iliacus, quadratus lumborum, and four intertransversales lumborum.

Contains eight muscles.

*Dissection.*—Place the subject in the first position, and expose the parts by the removal of the parietes and viscera of the abdomen; remove the diaphragm, so as to expose the anterior parts of the psoæ muscles, and study first the iliac fascia which will now be exposed.

*Iliac fascia or lumbo-iliac aponeurosis.*—This is a strong membranous expansion covering the psoas magnus and iliacus, and giving origin to the sartorius muscle. Its internal border is attached to the tendon of the psoas parvus, its external to the outer border and corresponding angle of the ilium; anteriorly it becomes gradually attenuated, and ends in areolar tissue; posteriorly it also decreases in thickness, and is inserted, along with the two muscles it covers, to the internal trochanter of the femur. The anterior part of its lower surface is covered by peritoneum, the posterior by the sartorius, and the outer extremity of Poupart's ligament, to both which it gives attachment.

Thickness, extent, and attachment of the iliac fascia.

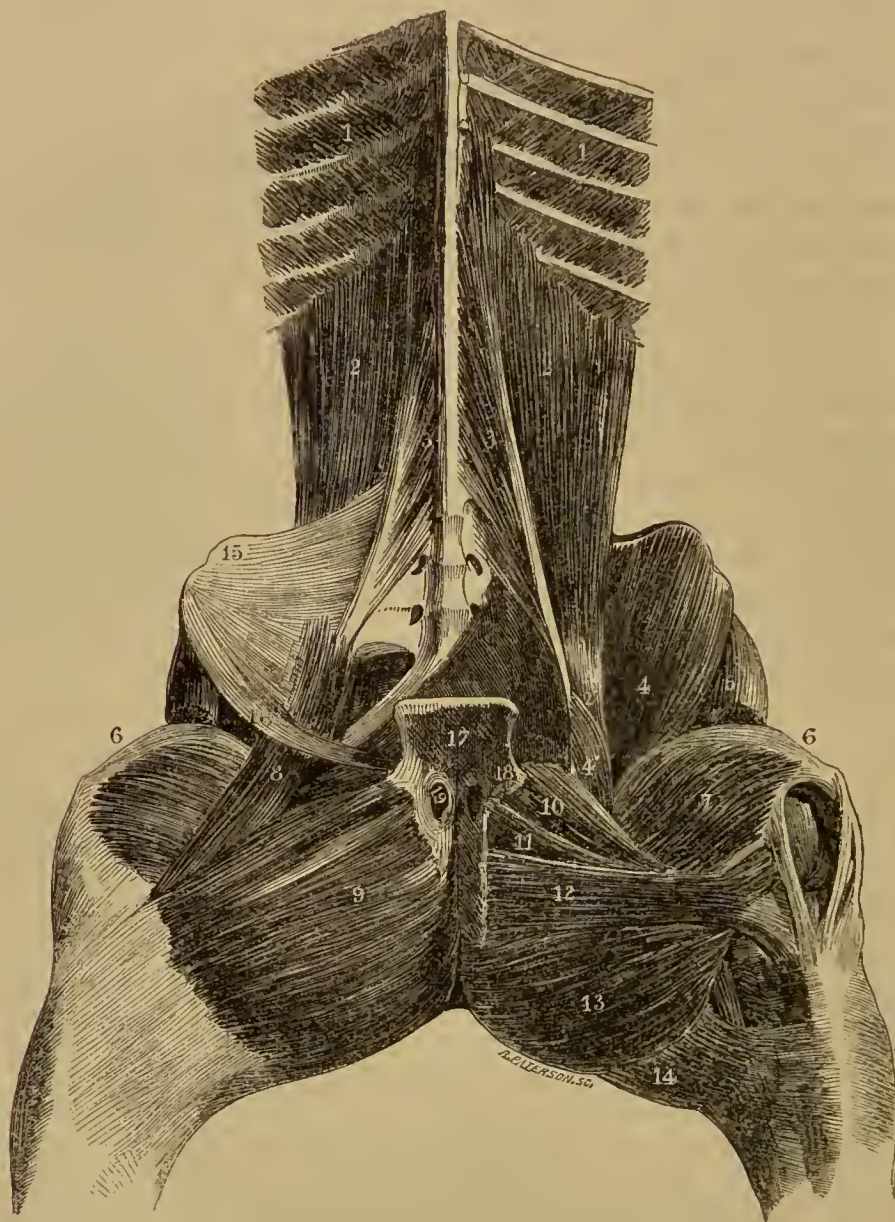


Fig. 185.

## MUSCLES OF THE SUBLUMBAR REGION AND INNER SIDE OF THE THIGH.

- |                               |   |
|-------------------------------|---|
| 1 1. Internal intercostals.   | 10. Pectineus.  |
| 2 2. Psoas magnus.            | 11. Anterior portion of the triceps adductor femoris. |
| 3 3. Psoas parvus.            | 12. Median portion of same.                           |
| 4. Iliacus.                   | 13. Posterior portion of same.                        |
| 4'. Internal portion of same. | 14. Semitendinosus.                                   |
| 5. Tensor vaginæ femoris.     | 15. Part of the iliac fascia.                         |
| 6 6. Rectus femoris.          | 16. Ponpart's ligament.                               |
| 7. Vastus internus.           | 17. Prepubian tendon.                                 |
| 8. Sartorius.                 | 18. Origin of the pubio-femoral ligament.             |
| 9. Gracilis.                  |   |

*Dissection.*—By raising this fascia, together with the anterior portion of the sartorius, the psoas muscles and the iliacus will be brought into view.

*Psoas magnus*, (sublumbo-trochantineus, Gir.)—(Fig. 185, No. 2.) Position and form.  
—This is a long muscle, lying along the lower aspect of the transverse processes of the lumbar vertebræ and the ilium. It is bulkiest in the middle, and smaller towards the extremities. The anterior extremity is broad and flattened from above downwards; its median part is prismatic, and its posterior extremity assumes a conical form to terminate in a short tendon, common also to the iliacus. With the exception of Structure. its lower extremity, this muscle is almost entirely formed of delicate muscular fibres, which are easily lacerated, even during the life of the animal. The fibres are longest superficially and towards the inner border.

It is *attached* anteriorly to the heads of the two last ribs, the Origin. bodies of the two last dorsal vertebræ, the transverse processes of all the lumbar vertebræ, and the bodies of all except the last; posteriorly the tendon common to it and the iliacus is *inserted* on the internal Insertion. trochanter.

The anterior or lumbar portion is related internally to the psoas Relations. parvus, while by its inferior surface it responds to the pleura, the Sublumbar portion. diaphragm, the iliac fascia, and sartorius; by its superior, to the heads of the two last ribs, the corresponding vertebro-costal articulations, the two last internal intercostals, and to the quadratus and transversales lumborum. The posterior or iliac portion responds internally and externally to the two heads of the iliacus, between which Iliac portion. it is received.

In the event of the loins being a fixed point, this muscle acts as a Action. powerful flexor and slight rotator of the thigh. When, on the other hand, the thigh is a fixed point, it flexes the loins.

*Differences.*—In *carnivora* this muscle is little developed, and Is small in the dog. never extends further forwards than the last dorsal vertebræ; opposite the brim of the pelvis it gives off some muscular fibres which become inserted into the pubis along with the psoas parvus.

*Psoas parvus*, (sublumbo-pubialis, Gir.)—(Fig. 185, No. 3.)—This Situation. muscle is extended between the side of the bodies of the lumbar vertebræ and the inner margin of the last muscle. It is long, flat, and semipenniform, having a flattened tendon running along its external Form and structure. border, by which it takes its posterior insertion, and to gain which the muscular fibres run backwards and outwards.

It arises from the heads of the three last ribs, from the bodies of Origin.



- the three or four last dorsal, and of all the lumbar vertebræ; it is *inserted* on the ilio-pectineal crest, and sends some fibres to the iliac fascia.
- Insertion.**
- Relations.** By its inferior aspect it responds to the pleura, the diaphragm, the posterior aorta, and vena cava, the sympathetic nerve, and the peritoneum; by its internal it lies in connection with the pillars of the diaphragm, by its external with the psoas magnus, and by its superior with the bodies of the vertebræ. Its substance is traversed by numerous vascular and nervous trunks.
- Action.** In the case of the loins being a fixed point, this muscle will flex the innominate bones upon the spine; should the pelvis be fixed it will flex the loins to one side, or in the event of both muscles acting, will bend them downwards. It also renders tense the iliac fascia.
- Large in carnivora.** *Differences.*—In *carnivora* this muscle is relatively larger than the psoas magnus, but takes its origin no farther forwards than the last dorsal vertebra.
- Position, form, and structure.** *Iliacus*, (ilio-trochantineus, Gir.)—(Fig. 185, No. 4, 4'.)—This is a short but thick and powerful muscle, occupying the venter ilii, and divided by the groove, for the reception of the psoas magnus, into two unequal portions, of which the external is the larger. The fibres of both parts run downwards, backwards, and inwards, converging posteriorly to take their insertion by the tendon, common to this muscle and the psoas magnus. The bulk of the muscle is formed of muscular fibres, the posterior extremity alone being tendinous.
- Origin.** It arises from the whole venter ilii, from the external angle of the same bone, from the ilio-pectineal crest and the sacro-iliac ligament.
- Insertion.** Posteriorly it is *inserted*, along with the psoas magnus, to the trochanter minor internus. Its inferior aspect is related to the iliac fascia, the sartorius, the pectineus, the psoas magnus, and the circumflex artery of the ilium; its superior to the ilium; its external border responds to the tensor vaginæ, and the origin of the rectus femoris, from which it is separated by some adipose tissue; its internal lies in connexion with the femoral artery, vein, and lymphatics. It acts as a flexor and slight rotator of the thigh.
- Relations.**
- Action.**
- Small in the dog.** *Differences.*—In *carnivora* this muscle is small and scarcely separable from the psoas magnus.
- Position.** *Quadratus lumborum*, (sacro-eostalis, Gir.)—Placed below the transverse processes of the lumbar vertebræ, between their extremities and the psoas magnus, the quadratus lumborum is composed of
- Form and structure.**

several flat muscular bundles, more or less continuous with each other. It contains a considerable amount of tendinous fibres.

The external or longest bundle *originates*, by tendon, from the anterior angle of the sacrum, runs forwards below the ends of the lumbar transverse processes, to each of which it is attached, and is *inserted* ultimately upon the posterior border of the last rib. The other parts, originating from the internal border of that just described, run inwards and forwards to take their insertions on the transverse processes of the lumbar vertebræ, and on the inner aspect of the two or three last ribs.

Outer bundle, its origin, and insertion. Arrangement of the internal bundles.

By its superior aspect it is related to the intertransversales, to the small retractor costæ, and to one or two of the internal intercostals; by its inferior, to the psoas magnus, and the lower divisions of the lumbar nerves.

Relations.

In acting it pulls backwards the last ribs, and turns the spine to one side.

*Differences.*—In *carnivora* this muscle is relatively more extensive and powerful than in *herbivora*.

Dog has large quadratus lumborum.

*Intertransversales lumborum.*—Four of these muscles exist on each side between the transverse processes of the first five lumbar vertebræ. They are small flattened muscles, thickly intermixed with tendinous fibres, and fill up the intervals between the transverse processes, becoming *attached* to their contiguous margins. They respond superiorly to the longissimus dorsi, and inferiorly to the quadratus lumborum and psoas magnus. If those on one side act, the loins are curved laterally; if both sides act at once, they are fixed.

Number.

Form, structure, position, and attachments.

Relations.

#### COCCYGEAL REGION.

This region is composed of four pairs of muscles, three of which, the *sacro-coccygeal*, are arranged longitudinally around the coccyx, which they envelope as in a sheath; the fourth, the *ischio-coccygeus*, is placed on the postero-lateral aspect of the pelvis. The three sacro-coccygeal muscles, named respectively the superior, inferior, and lateral, are elongated bundles arranged along those aspects of the coccyx indicated by their names. They diminish in size from before backwards, are inserted on all the coccygeal bones by short tendons, of which the posterior are the longest, and are all enveloped in a common fibrous sheath of considerable thickness, called the coccygeal aponeurosis.

Four pairs of muscles.

Sacro-coccygeal.

Their general form.

Their aponeurosis.

*Sacro-coccygeus superior*, (erector coccygis).—(Fig. 184, No. 21.)—

Position.

Origin.	Placed along the superior aspect of the sacrum and coccyx, this muscle <i>arises</i> from the sides and extremities of the three or four last spinous processes of the sacrum, and is <i>inserted</i> on the superior aspect of all the coccygeal bones. It responds superiorly to the coccygeal aponeurosis, inferiorly to the coccygeal vertebræ, internally to its fellow, externally to the sacro-coccygeus lateralis, and at its anterior part to the aponeurosis of the semispinalis lumborum. Acting with its fellow, it raises the tail; if one only acts, it turns that organ also to one side.
Insertion.	
Relations.	
Action.	
Position.	<i>Sacro-coccygeus inferior</i> , (depressor coccygis).—Situated beneath the sacrum and coccyx, this muscle is larger than the erector, and forms a rounded mass beneath the tail. It <i>originates</i> from the inferior aspect of the sacrum as far forwards as its third segment, and from the sacro-sciatic ligament; its <i>insertion</i> is effected on the inferior surface of all the bones of the tail. It responds superiorly to the sacrum and coccyx, inferiorly to the coccygeal aponeurosis, internally to its fellow and to the fascia attaching the rectum, externally to the sacro-sciatic ligament, the ischio-coccygeus, and the coccygeal aponeurosis. Its action is to pull the tail downwards, and when one only acts, to one side.
Origin.	
Insertion.	
Relations.	
Action.	
Situation.	<i>Sacro-coccygeus lateralis</i> , (curvator coccygis).—Placed along the lateral aspect of the sacrum and coccyx, this muscle holds in this region a position analogous to that of the semispinalis in other spinal regions. It <i>arises</i> from the lateral aspect of the sacral spine, and, along with the semispinalis lumborum, from the two last lumbar spines, and is <i>inserted</i> on the lateral aspect of the coccygeal bones. It is related externally to the posterior extremity of the longissimus dorsi, the inferior sacro-iliae ligament, and the coccygeal aponeurosis, internally to the semispinalis lumborum and the bones of the tail, superiorly to the erector coccygis, and inferiorly to the depressor coccygis. From the last-named muscle it is separated by some small muscular bundles running from one coccygeal vertebra to another. This muscle is easily separable into a superior and an inferior portion.
Origin.	
Insertion.	
Relations.	
Action.	It turns the tail to one side.
Form and position.	<i>Ischio-coccygeus</i> , (compressor coccygis).—(Fig. 184, No. 22.)—This is a thin, flat, triangular muscle, placed on the postero-lateral aspect of the pelvis, within the sacro-sciatic ligament, and quite separate from the sacro-coccygeal muscles, except at its insertion. Its anterior border <i>originates</i> by an aponeurotic expansion from the sacro-sciatic ligament and supra-cotyloid crest; its fibres run upwards to be <i>inserted</i> on the transverse processes of the last sacral segment and several of the first
Origin.	
Direction.	
Insertion.	



bones of the tail. It responds externally to the sacro-sciatic ligament; internally, to the rectum and sacro-coccygeus lateralis. The ischio-coccygeal muscles depress the tail.

*Differences.*—The ischio-coccygeus is broader and thicker in *ruminants*. In *carnivora*, in which the same remark holds good, its colour is deeper, and it takes its origin from the supra-cotyloid crest only.

Relations.

Action.

Ruminants  
and carni-  
vora.

## SUPERIOR CERVICAL REGION.

The superior cervical region, or the triangular space comprised between the transverse processes of the cervical vertebræ, the superior border of the ligamentum nuchæ, and the spinous process of the second dorsal vertebra, contains sixteen pairs of muscles, together with the anterior portions of the serratus magnus and longissimus dorsi. Those proper to this region may be thus enumerated: *cervical trapezius, rhomboideus anterior, splenius, complexus, trachelo mastoideus, semispinalis colli, six intertransversales colli, obliquus capitis posticus, obliquus capitis anticus, rectus capitis posticus major, and rectus capitis posticus minor*. These may be described in four layers, according to the order in which they lie.

Has sixteen  
pairs of  
muscles.

## FIRST LAYER.

*Cervical trapezius*, (cervico acromialis, Gir.; superior portion of the trapezius in man).—(Fig. 176, No. 8).—Situated upon the side of the neck in front of the scapula, this muscle is flat and very thin, formed of muscular fibres on its median part, and a dense aponeurosis at each extremity. The muscular fibres, which are directed downwards and backwards, are longest towards the inferior border, unless when intersected, as they sometimes are at this point, by aponeurosis.

Situation,  
form, and  
structure.

It is *inserted*, anteriorly, by an aponeurosis to the funicular portion of the ligamentum nuchæ, and posteriorly by a fascia which joins that of the dorsal trapezius to the tubercle on the spine of the scapula; part passes with the levator humeri into the interstice between the two parts of the abductor brachii.

Origin.

Insertion.

It is enveloped by, and most intimately adherent by its inner and outer aspects to two aponeurotic expansions from the corresponding surfaces of the levator humeri. By its internal aspect it responds to the ramifications of the posterior cervical artery, rhomboidens anterior, splenius, serratus magnus, pectoralis prescapularis, and antea spinatus. In contracting, it raises and advances the shoulder.

Relations.

Action.

Larger in  
ox, pig, and  
dog.

*Differences.*—In *ruminants* this muscle is at once broader and thicker than in the horse. In the *pig* and *dog* it extends farther forwards, and takes its insertion, by an aponeurotic expansion, upon the occipital crest.

#### SECOND LAYER.

*Dissection.*—Separate the last muscle from its attachments, and remove it; cut through the superior insertions of the levator humeri, and reflect it downwards; do the same by the cervical portion of the serratus magnus, but preserve its cervical attachments, that its connection with the other muscles of the neck may be studied. The rhomboideus anterior and the splenius will now be exposed.

- Position.* *Rhomboideus anterior*, (relveur propre de l'épaule, Chauveau; cervico subscapularis, Gir.; rhomboideus superior of man).—This muscle is placed on the side of the neck, just beneath the funicular portion of the ligamentum nuchæ. It is of a triangular form, elongated from before backwards, flattened from within outwards, and tendinous only at its extremities. The muscle is composed of thick fleshy fasciculi, of which those at the inferior border are the longer.
- Form.*
- Structure.*
- Origin.* Its superior border is attached by short tendinous fibres to the funicular portion of the ligamentum nuchæ as far forwards as the axis. It is *inserted* through a similar medium, at its posterior extremity, to the inner aspect of the cartilage of the scapula, in front of the attachment of the rhomboideus posterior and above that of the serratus magnus.
- Insertion.*
- Relations.* Its external aspect is *related* to the cervical trapezius, its internal to the splenius, which has a slight depression superiorly for its reception; on its inner aspect ramify some large branches of the dorsal and superior cervical arteries.
- Action.* It pulls the superior extremity of the scapula upwards and forwards.
- Anterior extremity is bifid in the dog and pig.* *Differences.*—In the *dog* and *pig* this muscle is bifid anteriorly, the inferior being a small muscular band attached, in the former animal, to the mastoid, and in the latter to the occipital crest.
- Form and position.* *Splenius*, (cervico-trachelius, Gir.)—(Figs. 176, 185, No. 3.)—This is a broad, flat, and triangular muscle, placed upon the side of the neck in that space comprised between the funicular portion of the ligamentum nuchæ and the transverse processes of the cervical vertebræ. It is composed of a number of muscular fasciculi, which run upwards and forwards, and are terminated by an aponeurosis.
- Structure.*

It is attached: 1st, Upon the first four dorsal spines, along with an aponeurosis, common also to the anterior small serratus of the back and the complexus; 2nd, Upon the whole of the cord-like portion of the ligamentum nuchæ; 3rd, Upon the transverse processes of all the cervical vertebræ, its insertion on the atlas being by a tendon common also to the trachelo-mastoideus and levator humeri; 4th, By a tendon common to this muscle and the trachelo-mastoideus to the mastoid crest.

Attachments.

Covered along its superior border by the rhomboidei muscles, the external aspect of the splenius responds posteriorly to the serratus magnus, and anteriorly to the cervical trapezius and levator humeri. Its internal surface is related to the complexus, the trachelo mastoideus, and to the oblique muscles of the head. Its posterior border is in relation to, and partially continuous through, a fascia, with the median portion of the longissimus dorsi.

Relations.

According as one or both muscles act, the head and neck will be turned to one side, or raised and extended.

Action.

*Differences.*—In *ruminants* this muscle is less developed, both in breadth and thickness, has no insertion on the last six cervical vertebræ, and is attached to the atlas and mastoid crest by a common short aponeurosis.

Small in ruminants.

In the *pig* its anterior extremity is divided into three muscular projections, which take insertion respectively upon the wing of the atlas, and the mastoid and the occipital crests.

Is trifid anteriorly in the pig.

In *carnivora* this muscle is of great breadth and thickness. Its anterior border is inserted only on the occipital and mastoid crests and wing of the atlas.

Large splenius in the dog.

### THIRD LAYER:

*Dissection.*—In exposing the third layer, comprising the complexus and trachelo mastoideus, the splenius must be cut through in the direction of the neck, and the flaps reflected upwards and downwards.

*Complexus*, (dorso-occipitalis, Gir.; complexus major, Per.)—(Fig. 184, No. 1.)—This is a somewhat flattened, triangular muscle, situated beneath the splenius, with which it agrees in form, except that it is thicker. It is divided from before backwards into two parts, a superior and an inferior, both of which contain a considerable amount of tendinous fibres.

Situation and form.

Contains much tendon.

The superior portion, the larger of the two, has its fibres running directly forwards; they are broken at intervals by tendinous inter-sections, directed from below obliquely upwards and forwards; it takes its origin by an aponeurosis.

Superior portion. Its structure.



Structure of the lower portion.	The inferior portion has both its tendinous and muscular fibres running upwards and forwards, to be fixed upon the superior part. These parts are divisible at their origin, but become inseparable in their anterior half, and terminate by a common tendon.
Origin of superior portion.	The superior division <i>originates</i> from the first four dorsal spines by the fascia common to the splenius and small anterior serrated muscle; also by flat tendinous prolongations from the transverse processes of the third and four following dorsal vertebræ. The inferior part <i>arises</i> by tendinous prolongations from the transverse processes of the two first dorsal, and by the lower border of its muscular part from the articulating processes of all the cervical vertebræ. Anteriorly, the common tendon is <i>inserted</i> on the posterior aspect of the occipital crest, to the side of the cervical tuberosity.
Origin of inferior portion.	
Common insertion.	
Relations.	It is related externally to the splenius, to the trachelo-mastoidæus, and at its origin to the inferior portion of the longissimus dorsi. It responds internally to the straight and oblique muscles of the head, to the laminar portion of the ligamentum nuchæ, and the superior division of the longissimus dorsi. The superior cervical artery passes between the two portions into which the muscle is divided posteriorly.
Office.	The complexus is a powerful extensor and slight rotator of the head.
More divided in the pig.	<i>Differences.</i> —In <i>ruminants</i> this muscle takes its <i>origin</i> from the ten first dorsal vertebræ. In the <i>pig</i> it is divided into two portions, except at its anterior insertion. Its posterior aponeurosis is distinct from that of the splenius and small serrated muscle. In <i>carnivora</i> it takes its origin no further back than the third dorsal spine. It is undivided.
Form and position.	<i>Trachelo-mastoidæus</i> , (dorso-mastoidæus, Gir.; complexus minor, Ch.)—(Fig. 184, No. 2.)—This is a long, narrow, fusiform muscle, extended along the whole inferior border of the complexus.
Divisions.	It is composed of two distinct fleshy bodies, a superior and an inferior, the former being the larger. The two portions run parallel to each other, and each terminates anteriorly in a tendon; that of the superior is flattened, that of the inferior is round.
Origin.	Both divisions <i>originate</i> by the aponeurosis, common also to the complexus, from the transverse processes of the two first dorsal vertebræ; also from the articular processes of the last six cervical vertebræ. The tendon of the superior, which is common also to the splenius, is <i>inserted</i> on the mastoid crest; that of the inferior is
Insertions of two tendons.	

attached to the wing of the atlas, having first received a slip each from the splenius and levator humeri.

The trachelo-mastoideus is covered by the inferior portion of the longissimus dorsi, the splenius, and at its superior insertion by the aponeurosis of the levator humeri; internally it responds to the complexus and the oblique muscles of the head. Relations.

This muscle turns the head and anterior part of the neck to one side. With its fellow on the opposite side, it tends to elevate the former. Action.

*Differences.*—In the *pig* the lower division of the muscle cannot be perfectly separated from the intertransversales or lower portion of the longissimus dorsi. In the *dog* the lower belly is little developed. Pig and dog.

#### FOURTH LAYER.

*Dissection.*—To expose the deepest layer of cervical muscles, the two muscles of the third layer must be cut through in their fleshy portions, and removed by carefully separating them from their attachments; the cervical insertions of the longissimus dorsi must also be cut through, and that muscle reflected backwards.

*Semispinalis colli*, (spinalis brevis, Bourg.; dorso-spinalis, Gir.)—Situated upon the laminæ of the five last cervical vertebræ, between the articulating and spinous processes, the semispinalis colli is formed of five short thick muscular divisions, which are truly a continuation of the semispinalis dorsi. The muscular are abundantly mixed with tendinous fibres, and both run forwards, upwards, and inwards from the lower to the upper attachments. Situation.  
Five bundles.  
Structure.

It arises from the posterior articulating processes of the last five, and is inserted on the spines and posterior borders of the laminæ of the second, third, fourth, fifth, and sixth cervical vertebræ. Origin.  
Insertion.

It responds superiorly and externally to the complexus, inferiorly to the laminæ of the vertebræ and interlamellar ligaments, internally to the ligamentum nuchæ and the superior portion of the longissimus dorsi. Relations.

This muscle extends the neck, or gives it a lateral inclination. Action.

*Differences.*—It is shorter and thicker, as a general rule, in the other domestic animals.

*Intertransversales colli*, (intercervicales, Gir.)—These are placed on the lateral aspect of the cervical vertebræ, between the transverse and articulating processes. They are made up of six distinct muscles on each side, very tendinous, and having each its fibres directed, like the muscle itself, from the articulating process of one vertebra to the Position.  
Six pairs.  
Structure, direction, and attachments.

- Relation to the spinal nerves, etc. transverse process of that in front. Each muscle is divided into a superior and inferior portion, between which the inferior branch of the corresponding cervical nerve gains its exit. Covered by the insertions of the splenius, serratus magnus, scalenus, reetus capitis anticus major, and longus colli, they respond by their internal aspects to the vertebræ, the vertebral artery and vein, and the foramina of conjugation.
- Action. They incline the neck in a lateral direction.
- Situation. *Obliquus capitis posticus*, (axoido-atloideus, Gir.)—(Fig. 184, No. 4.)—Situated obliquely upon the side of the two first cervical vertebræ, this is a broad, flat muscle, thickest at its median part, made up of muscular fibres running in the direction of the muscle, and becoming shorter as they are more deeply situated.
- Form and structure.
- Origin. It *originates* posteriorly from the lateral aspect of the spinous process of the axis, and takes its *insertion* on the superior aspect of the wing of the atlas.
- Insertion.
- Relations. It responds externally to the splenius and trachelo-mastoidcus; internally to the two first cervical vertebræ, with the articulation between them; superiorly to the superior straight, and inferiorly to the large inferior straight muscles of the head.
- Office. This muscle is the great rotator of the head, its chief action being to turn the atlas upon the axis.
- Form, structure, and situation. *Obliquus capitis anticus*, (atloido-mastoideus, Gir.)—(Fig. 184, No. 3.)—This is shorter and thinner, but more tendinous than the last. It is flat, quadrilateral, and placed in a direction from behind upwards and forwards upon the side of the occipito-atloid articulation.
- Origin. It *arises* from the anterior aspect of the roughened border which surrounds the wing of the atlas, and is *inserted* on the mastoid crest and styloid process of the occipital bone. It is covered by the superior aponeuroses of the splenius and levator humeri, by which it is separated from the parotid gland, also by the mastoid tendon of the trachelo-mastoidcus; it covers in turn the occipito-atloid articulation, the anterior insertion of the posterior straight muscles of the head, and the origins of the stylo-hyoidcus, stylo-maxillaris, and digastricus. It produces lateral inclination and slight extension of the head.
- Insertion.
- Relations.
- Action.
- Form and position. *Rectus capitis posticus major*, (complexus minor and reetus posticus major of Bourgelat; atloido-occipitalis of Girard).—This is an elongated prismatic muscle, situated above the two first cervical vertebræ on one side of the ligamentum nuchæ, and which cannot be



completely separated from the complexus, nor the small posterior straight muscle of the head. It is divisible, though imperfectly, into a superficial and a deep portion, and has hence been considered by Bourgelat as two distinct muscles. It *originates* from the superior spinous crest of the axis, and is directed forwards and outwards to be *inserted* on the cervical tuberosity of the occipital bone, having first plunged beneath the small oblique muscle of the head; some of its superficial fibres go to the tendon of the complexus. It responds superiorly and externally to the muscle just named, and to the anterior oblique; internally to the ligamentum nuchæ and its fellow on the opposite side, inferiorly to the small superior straight muscle of the head.

Two portions.

Origin.

Insertion.

Relations.

*Rectus capitis posticus minor*, (atlido-occipitalis, Gir.)—This is a small flat, triangular muscle, not quite distinct from that last described, placed directly on the superior aspect of the occipito-atloid joint. It *arises* from the superior aspect of the ring of the atlas, and is *inserted* upon the posterior surface of the occipital bone beneath that of the large muscle of the same name.

Form and position.

Origin.

Insertion.

The posterior recti muscles of the head replace the interspinous ligaments of other regions, and the interspinous muscles of man and carnivora, the anterior insertion of the major having been simply extended to the occiput, to permit free rotation of the first on the second cervical vertebra. The action of both is alike, namely, to extend the head.

Represent interspinous ligaments.

Action.

*Differences*.—In the *ox* and *pig* these muscles are less distinct than in the horse. In *carnivora*, both these and the oblique muscles are largely developed.

Well developed in carnivora.

#### INFERIOR CERVICAL REGION.

In this region we meet with *nine pairs of muscles*, exclusive of the cervical portion of the panniculus already described. They may be enumerated as follows:—*Levator humeri*, *sterno-maxillaris*, *sterno-thyro-hyoideus*, *subscapulo-hyoideus*, *rectus capitis anticus major*, *rectus capitis anticus minor*, *rectus capitis lateralis*, *scalenus*, and *longus colli*.

Contains nine muscles on either side.

These muscles envelope important structures which traverse this region, such as the trachea, œsophagus, carotid arteries, jugular veins, sympathetic, pneumogastric, and the recurrent laryngeal nerves.

*Dissection*.—By raising the skin, the cervical panniculus, and the parotid gland, the levator humeri, sterno-maxillaris, and sterno-thyro-hyoideus will be exposed.



Fig. 185.

## ANTERO-LATERAL VIEW OF THE BODY—SUPERFICIAL MUSCLES

- |  |   |
|--|---|
| 1 1. Sterno maxillaris.                                    | 9. Latissimus dorsi.                            |
| 2 2 2. Levator humeri.                                     | 10. Posterior part of the serratus magnus.      |
| 3. Splenius.   | 11. External oblique.                           |
| 4. Portion of serratus magnus.                             | 12. Posterior portion of the pectoralis magnus. |
| 5 5. Dorsal and cervical trapezei.                         | 13. Pectoralis parvus.                          |
| 6 7. Ant. and post. portions of the abductor<br>[brachii.] | 14. Pectoralis prescapularis.                   |
| 8. Caput magnum of the triceps extensor                    | 15. Gluteus medius.                             |



*Levator humeri*, (mastoido-humeralis, Gir.; humero-sterno-mastoidens, Rigot; common muscle of the arm, neck, and head, Bourg.; represents the eleido-mastoid, and the clavicular portions of the trapezius and deltoid of man, with the acromio-tracheleus, a muscular mass described by Cuvier as peculiar to quadruped mammals).—(Fig. 176, Nos. 6, 9; Fig. 185, No. 2.)—The levator humeri is extended along the infero-lateral part of the neck, and reaches from the head as far as the middle of the humerus. It is broad, flattened, thicker at its posterior than at its anterior part, and partially divided into two portions, a superficial and a deep.

Situation.

Form and division.

The *superficial portion* (Fig. 176, No. 6) is a flat muscular band, *attached* anteriorly by an expanded aponeurosis on the mastoid process and crest; posteriorly it is much thicker, and is *inserted* by a short aponeurosis common also to the pectoralis transversus, on the crest extending down from the external tubercle on the head of the humerus. Its inferior border is continuous posteriorly with the panniculus, and anteriorly, at its aponeurotic part, with the tendon of the sterno-maxillaris.

Superficial position.  
Anterior attachment.  
Posterior attachment.

Connections by its inferior border.

The *deep portion* (Fig. 176, No. 9) is thicker and shorter than the superficial, above and on the inner aspect of which it is placed. It is *attached* by a strong aponeurosis, common also to the cervical trapezius, into the narrow interval between the two heads of the abductor brachii. Anteriorly it divides into four fleshy bands, which become *inserted* on the transverse processes of the four first cervical vertebræ; that going to the atlas joins the common tendon of the splenius and trachelo-mastoideus. Its superior border is continued by a double layer of aponeurosis, inseparably united to both aspects of the cervical trapezius, as far as the superior insertion of that muscle.

Deep portion—its position.  
Posterior attachment.

Anterior attachments.

Connections by its superior border.

It is covered throughout its greater part by the aponeurosis of the panniculus, from which it is separated with difficulty; its anterior insertion lies beneath the parotid gland, and the cervico-auricularis muscles. It responds internally to the splenius, trachelo-mastoideus, oblique muscles of the head, inferior large straight muscle, digastricus, subscapulo-hyoideus, serratus magnus, scalenus, pectoralis anticus, flexor brachii, antea and postea spinati, and abductor brachii.

Relations.

When the anterior is the fixed insertion, it draws the shoulder and arm upwards and forwards in progression. When the posterior extremity is fixed, it inclines the superior part of the neck to one side, and slightly flexes the head.

Actions.

*Differences.*—In *ruminants* the two portions of this muscle are more distinct than in the horse. The superficial portion divides

Ruminants.



anteriorly into two prolongations, a superior and an inferior, which respectively represent the clavicular part of the trapezius and the cleido-mastoid of man. The former is inserted by a broad aponeurosis on the occipital and mastoid crests, the mastoid process, and the ligamentum nuchæ, along with the cervical trapezius. The latter unites with a muscle corresponding to the subscapulo-hyoideus, and goes to be inserted on the basilar process of the occiput, along with the large inferior rectus. The deep portion of the muscle is inserted on the atlas by a tendon proper to itself.

Connected  
with the  
first rib in  
the ox.

In the larger, though not in the smaller, ruminants, the superficial division receives a flat muscular band from the lower end of the first rib. In the sheep the muscle is inserted on the internal as well as the external tubercle on the head of the humerus.

Pig.

In the *pig*, this muscle is broader and more muscular. It is arranged like that of the ox, with this exception, that the lower anterior insertion of the superficial division is upon the mastoid crest, beneath the hiatus auditorius externus.

Dog.

In the *dog* the superficial portion is a thin flattened band, while the deep is largely developed. Its attachments are similar to those in the pig.

Form.

*Sterno-maxillaris*, (sterno-mastoideus of man, and several of the lower animals).—(Fig. 185, No. 1.)—This is an elongated narrow muscle, convex across its external surface, concave on its internal, extended upwards and outwards on the inferior aspect of the neck, along the lower border of the levator humeri, between which and this muscle lies the jugular vein. It has a fleshy body, narrowed at each extremity, and terminated anteriorly by a tendon. It *originates* from the cariniform cartilage, and is *inserted* anteriorly upon the curved portion of the posterior border of the lower jaw by its tendon, and upon the mastoid process by an aponeurosis, which joins that of the levator humeri. Covered by the panniculus, and at its superior insertion by the parotid gland, the sterno-maxillaris covers in turn the sterno-thyro-hyoideus, the side of the trachea, the subscapulo-hyoideus, the stylo-maxillaris, and the maxillary gland.

Situation.

Structure.

Origin.

Insertion.

Relations.

Action.

When both muscles act, they flex the head; when one only, the head is turned slightly to one side.

Ruminants.

*Differences*.—In *ruminants*, the superior tendon goes, with the superficial division of the levator humeri, to be inserted on the basilar process of the occiput.

Carnivora.

In the *dog* and *pig*, the tendon goes directly to the mastoid process.

*Sterno-thyro-hyoideus*, (sterno-hyoideus, and sterno-thyrodeus, of man).—Fig. 176, No. 7.)—This is a long, thin, ribbon-shaped muscle, extending throughout the whole length of the neck, along the anterior aspect of the trachea. It is rendered digastric by a tendinous intersection, generally about the middle of the neck, though not always at the same height upon both sides. *Originating* from the cariniform cartilage of the sternum, it is *inserted* on the inferior aspect of the body of the os hyoides along with the subscapulo-hyoideus, and to the posterior border of the thyroid cartilage. Responding internally to the trachea, it is covered at its lower part by the sterno-maxillaris, and superiorly by the panniculus. Below the tendon of intersection, this muscle is commonly confounded with that on the opposite side, so as to form a single body. The two muscles act together to depress the hyoid bone and larynx.

Form and position.

Has a median tendinous intersection. Origin.

Insertion.

Relations.

Connected with the opposite muscle inferiorly. Action.

*Differences*.—This muscle is not digastric in the other domestic animals. It is more bulky in the *ox*. In the *pig*, a part detached from the inferior border of the muscle, throughout its entire extent, takes its insertion on the lower margin of the thyroid cartilage; the superior portion is inserted on the superior border of this cartilage, and on the hyoid bone. In the *dog*, the common body of the sterno-thyro-hyoideus—or, more properly, the costo-thyro-hyoideus—originates from the cartilage of the first rib.

Is only digastric in the horse.

In dog arises from the first rib.

*Dissection*.—Divide the levator humeri transversely in front of the shoulder, and remove it from its attachments, taking care to leave the subscapulo-hyoideus and jugular vein in their natural positions, that the relations of these may be studied.

*Subscapulo hyoideus*, (hyoideus, Bourg.; omo-hyoid of man).—A thin, flattened muscular band, extended diagonally across the lower part of the neck, in a direction downwards, forwards, and inwards, from the anterior border of the scapula to the intermaxillary space. It *originates* by a short aponeurosis from the fascia, on the inner aspect of the subscapularis, and is *inserted* on the body of the hyoid bone, with the sterno-thyro-hyoideus, and with its fellow on the opposite side.

Form, position, and direction.

Origin.

Insertion.

Relations

It responds externally to the subscapularis, antea spinatus, pectoralis prescapularis, the levator humeri, to which it is intimately attached, the jugular vein, which it separates in the upper third of the neck from the carotid artery, and to the sterno-maxillaris. Its internal aspect is related to the scalenus, the large inferior rectus of the head,

the carotid artery, the recurrent, sympathetic, and par vagum nerves, the inferior aspect of the larynx, and the thyroid body.

Action.

It depresses the hyoid bone with the tongue and larynx.

In ruminants is a trachelo-hyoideus.

*Differences.*—In *ruminants*, and in the *pig*, this muscle is relatively smaller, and originates posteriorly from the transverse process of the third, fourth, or fifth cervical vertebræ, from which circumstance it has been called the *trachelo-hyoideus*. In *ruminants*, it sends some fibres to the levator humeri and the sterno-suboccipitalis, as these muscles go to be inserted on the basilar process of the occiput. This muscle is absent in the *dog*.

*Dissection.*—Having examined the subscapulo-hyoideus, detach the fore limbs, saw through and remove the lower half of the first eight ribs, taking care to preserve that part of the first which attaches the splenius; empty the thoracic cavity of its viscera, remove the trachea, with the muscles on its inferior aspect, the œsophagus, the larynx and pharynx, the jugular vein, carotid artery, and accompanying nerves. By this means will be exposed the longus colli, the scalenus, and the inferior straight muscles of the head.

Situation.

Form and structure.

Origin.

Insertion.

Relations.

*Rectus capitis anticus major*, (flexor capitis longus, Bourg.; trachelo-suboccipitalis, Gir.)—Placed on the infero-lateral aspects of the five first cervical vertebræ and on the base of the cranium. This is the largest of the three inferior recti; it has a muscular body, flattened from side to side in its posterior half, rounded on its anterior, and terminated in front by a tendon. It *arises* from the transverse processes of the second, third, fourth, fifth, and sixth cervical vertebræ, and is *attached* anteriorly by its tendon on the basilar process of the occiput at its union with the body of the sphenoid.

Covered by the scalenus, levator humeri, subscapulo-hyoideus, the guttural pouches, and the carotid artery, with its accompanying nerves, its superior aspect responds to the small rectus, obliquus capitis posticus, and the occipito-atloid articulations, while its internal is related to the longus colli and to its fellow on the opposite side.

Action.

It flexes the head, and if one only acts, turns it slightly to one side.

Double in ruminants and pig.

*Differences.*—In the *ox*, *sheep*, and *pig*, this muscle is divided into two parts, each originating from the second and four following cervical vertebræ, and the superficial confounding itself with the intertransversales; the latter, which is inserted on the tubercle beneath the body of the atlas, has been called the *trachelo-atloideus*. In the *dog* it has an arrangement similar to that of the horse.

Form.

*Rectus capitis anticus minor*, (flexor capitis brevis of Bourgelat; atloido-suboccipitalis, Gir.)—A small, fleshy mass, prismatic at its



middle, and flattened at each extremity, *originating* from the lower aspect of the atlas between the insertions of the longus colli, and the rectus lateralis, and *inserted* on the basilar process of the occiput, outside the large rectus. Covered by the guttural pouch, and towards its posterior insertion by the rectus major, it responds internally to the last-named muscle, and superiorly to the occipito-atloid articulation. It assists in flexing the head.

Origin.

Insertion.

Relations.

Action.

*Rectus capitis lateralis*, (flexor capitis parvus of Bourgelat; atloido-styloideus, Gir.)—Shorter and thinner than the last, but, like it, prismatic and fleshy throughout, this muscle covers the lateral aspect of the occipito-atloid articulation. It *originates* from the inferior plate of the atlas outside the origin of the rectus minor, and is *inserted* on the inner aspect of the styloid process of the occiput. It acts along with the inferior recti.

Form, structure, and position.

Origin.

Insertion.

Action.

*Differences*.—In the pig it is partially confounded with the obliquus capitis minor. Fig.

*Scalenus*, (costo-tracheus, Gir.)—(Fig. 184, No. 6.)—Placed on the inferior part of the neck, to the side of the anterior entrance of the thorax, and extended forwards and upwards, the scalenus is a short, flattened muscle, divided into a superior and an inferior part by an antero-posterior interstice, through which passes the brachial plexus.

Situation.

Direction.

Form.

Two portions.

The *inferior portion*, (scalenus anticus in man), much the larger, arises from the middle of the anterior border and outer aspect of the first rib, and is *inserted* on the transverse processes of the four last cervical vertebræ by short fleshy prolongations.

Origin of the lower portion;

its insertion.

The *superior portion*, (scalenus posticus of man), *originates* from the first rib near its superior extremity, and is *inserted* by three or four fleshy prolongations on the transverse processes of the three or four last cervical vertebræ.

Origin of the superior portion;

its insertion.

It responds externally to the subscapulo-hyoideus, levator humeri, pectoralis-prescapularis, the origin of the phrenic nerves and the brachial plexus; it is related internally to the longus colli, trachea, and primitive carotid, with its accompanying nerves; that on the left side is related to the œsophagus. The jugular vein runs along the inferior border of each muscle.

Relations.

When the first rib is fixed, the scalenus turns the neck to one side; when the neck is the fixed point, it pulls forwards and fixes the first rib, thereby affording an advantageous point from which the external intercostals may act during inspiration.

Its office.

*Differences*.—In ruminants the two parts of the scalenus are quite

Ox has two scaleni.

distinct. The superior is elongated, thin, and triangular, being attached on the outer aspect of the four first ribs, and the transverse processes of the three last cervical vertebræ. In the *pig* the superior scalenus is attached to the three first ribs, and the five last cervical vertebræ. In the *dog* the superior muscle extends from the three or four last cervical vertebræ to the outer aspect of the first seven ribs. The brachial plexus passes beneath the lower scalenus.

*Longus colli*, (flexor longus colli of Bourgelat; subdorso-atloideus, Gir.)—Fig. 184, No. 5.)—Extended along the lower aspect of all the cervical and the first six dorsal vertebræ, the longus colli is so intimately united to that on the opposite side as to constitute a single mass.

Each lateral part is composed of a succession of muscular bundles, largely intermixed with tendinous fibres. The posterior bundle, the largest, *originates* from the lower aspect of the bodies of the first six dorsal vertebræ, and is *attached* to the lower tubercle of the transverse process of the sixth cervical vertebra. The anterior bundles, continuous with the posterior, are *attached* to the transverse processes of the six last cervical vertebræ, their fibres run inwards and forwards to the median line, where they take *insertion* on the inferior spines of the same vertebræ. The last bundle, with some fibres from the contiguous bundles, *terminates* by a strong tendon, which is *attached* on the tubercle, on the lower aspect of the atlas.

It responds inferiorly to the trachea and œsophagus, with their accompanying vessels and nerves; superiorly to the vertebræ which it covers, and their intervertebral discs; laterally the thoracic portion responds to the pleuræ, the sympathetic nerve, and the anterior intercostal vessels and nerves; the cervical portion to the scalenus and inferior large rectus, together with the vertebral and superior cervical arteries.

It flexes the cervical vertebræ collectively or individually, and, from the direction of its fibres, may operate a slight rotation of the neck.

*Differences*.—In the dog, and, above all, in the pig, the two lateral portions of this muscle are easily separated from each other, so that they may be considered as individual muscles.

#### AXILLARY REGION.

This region comprises the pectoral muscles, which may be considered as a pair, *superficial* and *deep*, or as four muscles formed by the subdivision of these.

*Dissection.*—Place the animal in the first position, and separate the fore-limbs from each other. Raise the skin with care, so that the subcutaneous muscles may not be interfered with; next separate the cervical portion of the panniculus, the levator humeri, and the cervical trapezius from their posterior attachments, and reflect them upon the neck. The superficial pectorals will thus be brought into view.

*Pectoralis superficialis*, (pect. transversus, Percivall; pectoralis magnus of man).—This large muscular mass, placed between the inferior crest of the sternum and the fore-arm, is composed of two portions, which, though not perfectly distinct from each other, are most conveniently described as two muscles. These are the pectoralis transversus and the pectoralis parvus. Imperfectly divided into two.

A.—*Pectoralis transversus*, (sterno-aponeuroticus, Ch.)—This is a flat quadrilateral muscle, occupying the space between the inferior border of the sternum and the fore-arm. It is made up of pale fleshy fibres, which run parallel to each other from their *origin*, from the whole inferior border of the sternum, outwards to the fascia of the fore-arm, upon which its aponeurosis takes *insertion*. The anterior fibres are also *inserted* by a fibrous expansion, common also to the levator humeri and pectoralis parvus, upon the crest on the outer aspect of the humerus. Its anterior border is covered by the levator humeri, and the remainder of its extent by the skin, to which it is intimately adherent through a layer of dense cellular tissue, traversed by numerous lymphatics. Its internal aspect responds to both muscles of the deep layer. Form and position.  
Structure and origin.  
Two insertions.  
Relations.

The pectoralis transversus adducts the limb, and renders tense the fascia of the fore-arm. Its close connection with the skin enables it also to supply the part of the panniculus in this region. Actions.

B.—*Pectoralis parvus*, (sterno-humeralis, Gir.)—Situated along the anterior border of the pectoralis transversus, which it partially covers, this muscle is short, thick, bulkiest at its median part, and, except at its very insertions, formed entirely of muscular fibres of a deep red colour. Situation.  
Form.  
Structure.

It arises from the cariniform cartilage, and the inferior border of the sternum, and is directed downwards, backwards, and outwards, to be *inserted* with the levator humeri, and pectoralis transversus, on the external tuberosity of the body of the humerus. Origin.  
Insertion.

It responds externally to the skin, from which it is separated by a dense areolar tissue, and to the cervical panniculus; internally to the pectoralis transversus, and pectoralis prescapularis. In a triangular Relations.



space, between this muscle and the posterior border of the levator humeri, runs the subcutaneous vein of the arm.

Action. It adducts the arm, and rotates it slightly.

Ruminants. *Differences*.—In *ruminants*, and in the *pig*, these muscles are relatively smaller, and less distinct from each other, than in the horse.

Carnivora. In *carnivora*, the pectoralis transversus is thin and narrow, and sends only a minute slip to the fascia of the fore-arm.

*Pectoralis profundus*, (pectoralis minor of man).—Unlike its homologue in man, this is enormously developed in the horse. It is completely divided into two muscles, the *pectoralis magnus*, and *pectoralis prescapularis*.

Situation. A.—*Pectoralis magnus*, (sterno-trochineus, Gir.)—This is an immense muscle, placed along the lower aspect of the abdomen, from the level of the ninth or tenth rib, as far as the supero-internal part

Form. of the arm, where it terminates. Its posterior third is thin, and flattened from above downwards, its median third is thicker but

Structure. narrower, while its anterior third is prismatic. It is entirely formed of muscular fasciculi, running nearly parallel to each other, from the posterior and internal borders of the muscle, to its prismatic portion. The fasciculi are accordingly longest towards the supero-external border. At its anterior extremity, the muscle contains a small amount of white fibrous tissue.

Origin. This muscle *arises* from the tunica abdominalis and the fascia of the external oblique, by means of a short aponeurosis continuous with its posterior border, from the cartilages of the false ribs, and from the lower aspect of that part of the sternum which corresponds to its three last segments. Its anterior extremity is *inserted* on the

Insertion. internal tubercle on the head of the humerus, and through the tendon of the coraco-humeralis to the coracoid process of the scapula. It is attached by a fibrous membrane which covers the tendon of the coraco-radialis to the internal and external lips of the bicipital groove, along with the antea spinatus.

Relations. The pectoralis magnus is covered posteriorly by the skin, to which it is closely adherent, and anteriorly by the pectoralis transversus and pectoralis prescapularis, also by the muscles, vessels, and nerves inside the arm, from which it is separated by the aponeurosis of the panniculus. The superior and internal aspect responds to the external oblique, rectus abdominis, serratus magnus, costo-sternalis, and pectoralis prescapularis, from all which it is separated by an abundant cellular tissue. Along its superior border runs the external thoracic

(spur) vein, and its anterior extremity is crossed superiorly by the humeral artery and vein.

It pulls the whole limb backwards and adducts it. It seems also to assist in extending the shoulder joint. Action.

*Pectoralis prescapularis*, (*pectoralis parvus*, Bourg.)—(Fig. 185, No. 14.)—Placed in front of the *pectoralis magnus*, this is a long, thick, prismatic muscle, occupying the side of the thorax and the anterior part of the shoulder, where it extends to the supero-anterior angle of the scapula. It is formed of muscular fasciculi, directed outwards and upwards, from their *origin* upon the cartilages of the first four ribs, and the lateral aspect of the anterior half of the sternum, to their *insertion* in front of the scapula on the aponeurosis covering the *antea spinatus*. Structure.  
Origin.  
Insertion.

The axillary part of this muscle responds externally to the *pectoralis magnus* and *pectoralis transversus*, and internally to the *costo-sternalis*, anterior costal cartilages, and intercostal muscles. Its prescapular portion is related externally to the *levator humeri* and *cervical trapezius*; internally, to the *subscapulo-hyoideus*, the *scalenus*, and the *serratus magnus*; posteriorly, it covers the *antea spinatus*. Relations.

It acts with the *pectoralis magnus* to pull the shoulder backwards and downwards, and, in addition, renders tense the scapular fascia. Action.

*Differences*.—In *ruminants*, and in the *pig*, the *pectoralis magnus* is relatively smaller. In the *dog*, it originates from the six last segments of the sternum, and is inserted on the internal and external tubercles on the head of the humerus, a small band from its anterior part going to the fascia inside the arm. In the *pig*, the *pectoralis prescapularis* is relatively larger in front of the shoulder than in solipedes, but posteriorly does not cover more than one chondro-costal articulation. In the other domestic quadrupeds, it does not extend up the front of the scapula, but terminates on the head of the humerus. In the smaller ruminants it is inseparably united to the *pectoralis magnus*. Ruminants.  
Pig and dog.  
  
Unless in the pig, does not extend in front of the scapula.

#### COSTAL REGION.

All the muscles belonging to this region are more or less engaged in the respiratory processes. They are fifty-four in number on each side, namely, the *serratus magnus*, the *costo-sternalis*, *seventeen external*, and *seventeen internal intercostals*, *seventeen levatores costarum*, and the *triangularis sterni*.

*Dissection*.—Place the subject in the third position; divide and turn back all

the muscles attaching the fore-limb to the trunk, except such as are inserted on the superior third of the scapula. Remove the fore-limb by sawing through the scapula between its upper and middle third. Dissect off the yellow elastic tissue which covers the posterior digitations of the serratus magnus, after which that muscle and the sterno-costalis may be studied.

*Serratus magnus*, (trachelo-subscapularis and costo-subscapularis, Gir.; triangularis scapulæ and serratus magnus, Ch.)—(Fig. 176, Nos. 4, 21; Fig. 185, Nos. 4, 10.)—Though described as two muscles by some French veterinarians, the serratus magnus is in reality single, and, following the example of Bourgelat, we shall consider it as such.

**Situation.** Placed on the lateral aspect of the thorax and the posterior part of the neck, this is an immense fan-shaped muscle, very thick towards its superior or central portion, but thin and digitated at its circumference, especially in the thoracic portion. It is composed of fleshy fibres, which converge from the circumference towards the base of the scapula, and are intermixed with tendon before taking *insertion* on that bone. The whole muscle is enveloped in an aponeurosis, which decreases in thickness from above downwards.

**Origin.** The serratus magnus *originates* from the transverse processes of the five last cervical vertebræ, and from the lower third and outer aspect of the eight true ribs, and is *inserted* on the anterior and posterior triangular surfaces of the venter scapulæ, between the subscapularis and rhomboidei muscles. Its aponeurosis becomes continuous with that on the inner aspect of the subscapularis.

**Relations.** It responds externally, in the thoracic region, to the subscapularis, antea spinatus, teres internus, pectoralis magnus, and large head of the triceps extensor brachii, from all which it is separated by an abundance of loose connective tissue; in the cervical region, it is covered by the cervical trapezius, the levator humeri, and the pectoralis prescapularis. Its internal aspect is related in the costal region to the seven first ribs, with the corresponding external intercostals, and to the anterior small serratus of the back; in the cervical region, to the splenius, the inferior branch of the longissimus dorsi, and the ilio-costalis. The four last serrations of this muscle digitate with the external oblique, and are covered by a prolongation of the abdominal tunic.

**Actions.** The whole of this muscle acts as an immense sling, by which the anterior half of the body is supported on the fore-limbs. Its action will vary according to which insertion is the fixed point. Thus, when the circumference is fixed, it will draw the scapula downwards and



forwards, or backwards, according as the anterior or posterior portions of the muscle are brought into play. When the scapula is the fixed point, the anterior portion raises the neck, or turns it to one side, while the posterior part pulls the ribs upwards and forwards, acting as an inspiratory muscle.

*Differences.*—In the *ox*, this muscle is attached to the six last cervical vertebræ. Towards its posterior border, it is thin and very tendinous, and this part is inserted upon the scapula by a flat tendon. The division into a cervical and a thoracic portion is more perfect than in the horse.

In the *dog* and *pig* the cervical portion is largely developed, and attached to the six last cervical vertebræ. Pig and carnivora.

*Costo-sternalis*, (lateralis sterni, Percivall; transversalis costarum, Rigot).—(Fig. 184, No. 8).—This is a flattened band, containing a large amount of tendinous fibres, extending upwards and forwards, and crossing the direction of the first four ribs, beneath the insertion of the serratus magnus. Form, structure, and direction.

Its posterior extremity is *attached* to the fourth costal cartilage, and by aponeurosis to the fifth cartilage and the sternum; its anterior extremity is attached to the outer aspect of the first rib, near its middle. Attachments.

Covered by the deep pectoral muscles, the costo-sternalis responds internally to the three first external intercostals, and the second and third ribs, to which it sometimes becomes attached. Relations.

It depresses the ribs, and assists in expiration. Action.

*Dissection.*—Remove the external oblique, the serrati muscles, large and small, the ilio-costalis, and the longissimus dorsi. The external intercostals and the levatores costarum will thus be exposed.

*Intercostales externi.*—These are seventeen in number on each side, corresponding to the number of intercostal spaces, which they fill. Each extends from the transverse process of the dorsal vertebra as far as the union of the ribs with their cartilages. Each becomes gradually thinner from above downwards. The muscular are thickly mixed up with tendinous fibres, and run obliquely downwards and backwards from their *origin*, at the posterior border of one rib, to their *insertion* on the outer aspect of the rib immediately behind. Number.  
Extent and form.  
Structure.  
Origin.  
Insertion.

They respond externally to the serrati and pectoral muscles, the external oblique, and the costo-sternalis; internally, to the internal intercostals. Relations.

Number, form, and structure.	<i>Levatores costarum</i> , (transversales costarum, Gir.; supra-costales, Rigot).—These are seventeen small, flat, triangular bundles, partly fleshy and partly tendinous, situated above the external intercostals, of which they are truly continuations. Each <i>originates</i> from the transverse process of a dorsal vertebra, and expands in a downward and backward direction, to be <i>inserted</i> on the outer aspect of the one or two succeeding ribs. They respond externally to the longissimus dorsi, and internally to the external intercostals.
Origin.	
Insertion.	
Connections.	
Situation.	<i>Intercostales interni</i> .—(Fig. 184, Nos. 7, 7.)—To observe these, it is necessary to dissect off the external intercostals. They agree with the latter in number, position, and general form, but differ in extending down to fill up the spaces between the cartilages of the ribs, and in being absent above the roughnesses representing the angles of the ribs. They are less tendinous than the external, and are thickest between the costal cartilages, from which their thickness gradually diminishes to their superior extremity. The fibres of each are directed from above downwards and forwards, from the anterior border of one rib to the posterior border and internal aspect of the rib next in front. They consequently cross those of the external. They are related externally to the external intercostals; internally, to the pleuræ and triangularis sterni.
Structure.	
Attachments.	
Relations.	
Situation.	<i>Triangularis sterni</i> , (sternalis, Bourg.; sterno-costalis, Gir.)—This muscle is situated within the thorax, above the sternum and the cartilages of the true ribs, so that in order to dissect it the lower ends of the ribs must be removed on one side. It is a broad flattened band, elongated from before backwards, digitated at its external border, and very tendinous.
Form and structure.	
Origin.	It <i>arises</i> from the lateral aspect of the superior common ligament of the sternum, and is <i>inserted</i> by digitations on the cartilages of the seven last true ribs. Its superior aspect is related to the pleuræ, its inferior to the costal cartilages, the internal intercostals and the internal thoracic artery and vein. A triangular interval, occupied by the pericardium, separates it from the opposite muscle.
Insertion.	
Relations.	
Actions of the costal muscles.	<i>Actions of the intercostals, levatores costarum, and triangularis sterni</i> .—The external intercostals, with the levatores costarum, and that portion of the internal intercostals comprised between the costal cartilages, pull the ribs forwards and outwards, rotating them upon their extremities, and thereby enlarging the capacity of the chest. The rest of the internal intercostals, the sterno-costalis, and the triangularis sterni, on the other hand, cause the ribs to rotate backwards
Inspiratory muscles.	
Expiratory muscles.	

and inwards, and consequently diminish the size of the thorax. The former are inspiratory, the latter expiratory muscles.

*Differences.*—In the *pig* the internal intercostals are continuous up to the vertebræ.

#### DIAPHRAGMATIC REGION.

This region contains one muscle only—the *diaphragm*.

*Dissection.*—The subject should be placed on the first position, and the abdominal muscles and viscera, including the great vascular trunks on the lower aspect of the lumbar vertebræ, removed. The peritoncum may then be dissected off the muscle, that its attachments may be exposed. In doing this, care should be taken not to allow the entrance of air into the chest, which would destroy the concavity of the muscle and interfere with its study.

*Diaphragm*, (*Δια*, across, and *φρασσω*, I close).—(Fig. 187.) This is a large musculo-fibrous septum, placed in the median part of the body, in a direction from above downwards and forwards, and dividing the thoracic from the abdominal cavity. It is flattened before backwards, and has an elliptical outline, with the greatest diameter from above downwards. Its posterior aspect is concave, its anterior convex.

The diaphragm is formed of a central *aponeurotic*, and a circumferential *muscular portion*; the former is called also the central tendon, cordiform tendon, or phrenic centre. The aponeurotic part is imperfectly divided into two lateral leaflets, by two muscular *crura* or *pillars*, which extend back upon the sublumbar region.

The *central tendon* is formed of white glistening fibres, which, originating from the muscular pillars, radiate in all directions towards the muscular portion with which it is continuous. Its right leaflet is pierced by a large opening for the posterior vena cava.

The *pillars* are distinguished as the *right* and the *left*. The *right pillar*, which is longer and thicker, but narrower than the left, is a great muscular mass, originating by a single flattened tendon from all the lumbar vertebræ through their inferior common ligament, and descending farther than the left into the aponeurotic portion. It is pierced by an elliptical opening for the passage of the œsophagus and pneumogastric nerve. The *left pillar* is a smaller muscular mass, projecting less into the aponeurotic portion, and the tendon of which does not extend back to the two or three last lumbar vertebræ. Its

Situation.

Form.

Divisions.

Central tendon.

Opening for the vena cava.

Right crus is the largest; its origin.

Esophageal opening.

Left crus is shorter.



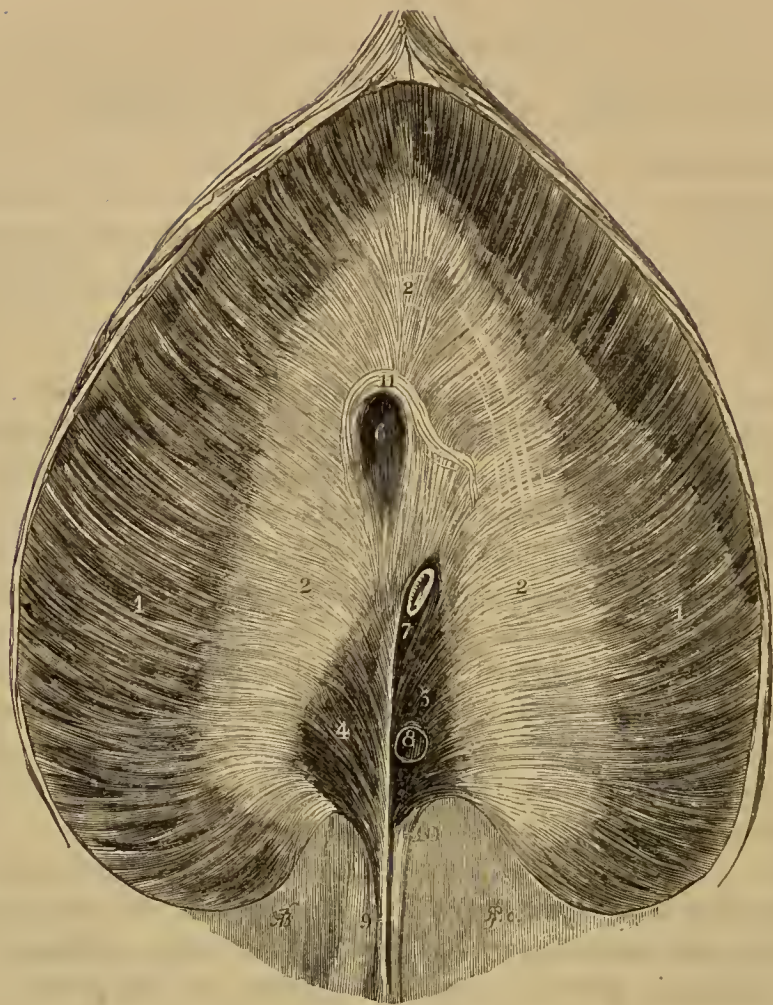


Fig. 187.

## VIEW OF THE POSTERIOR ASPECT OF THE DIAPHRAGM.

- |                                       |   |
|---------------------------------------|---|
| 1, 1, 1. Peripheral muscular portion. | 7. Foramen for the œsophagus.                   |
| 2, 2, 2. Central tendinous portion.   | 8. Hiatus aorticus.                             |
| 3. Sternal attachment.                | 9. Tendon of the left pillar.                   |
| 4. Left pillar.                       | 10. Tendon of the right pillar.                 |
| 5. Right pillar.                      | 11. Fibrous bundle below the foramen quadratum. |
| 6. Foramen for the vena cava.         |   |

median part is separated from the right by a large opening, for the transmission of the posterior aorta and thoracic duct. Aortic opening.

The *circumferential muscular portion* is continuous by its internal border with the central tendon. From this its fibres diverge towards its periphery, where it terminates by digitations. On the left side it joins the corresponding pillar, and entirely surrounds the central tendon, but on the right side the latter intervenes between it and the pillar. The circumference of the fleshy portion is *inserted* to the lower ends of the last eleven ribs on their inner aspects, and sometimes to their cartilages of prolongation. These insertions on the ribs are separated by a narrow interval from the costal attachments of the transversalis abdominis. Muscular portion.  
Course of its fibres.  
Insertions.

The anterior aspect of the diaphragm is related to the lungs through the intervention of the pleuræ, by which it is covered. Towards its sternal insertion it is separated from the latter by a layer of yellow elastic tissue, which fortifies this otherwise weak part against the pressure of the viscera. Its posterior surface, which is immediately covered by peritoneum, responds to the stomach, colon, spleen, and liver, to the latter of which it is directly attached. On each side of the pillars the circumference of the muscle forms an arch which embraces the psoas muscles. Relations.

The diaphragm is the chief agent in inspiration. By the contraction of the pillars and radiating muscular portion, the posterior cavity is diminished, and the capacity of the chest enlarged. While the size of the thorax is by this means increased, that of the abdomen is necessarily diminished, since the backward motion of the diaphragm must compress its contents. This compression is very powerful when combined with that of the abdominal muscles, as it is in the expulsion of urine, or fæces, or in the act of parturition. Action  
on the thorax;  
on the abdomen.

*Differences.*—In the *larger ruminants*, the pillars are larger and of greater length. The costal attachments of the muscle are farther from the cartilages of prolongation than in the horse. Ruminants.

## MUSCLES OF THE HEAD.

### FACIAL REGION.

This region, which surrounds the anterior orifices of the mouth and nostrils, contains thirteen muscles, namely, *orbicularis oris*, *alveolo-labialis*, *zigomato-labialis*, *lacrymo-labialis*, *super-maxillo-* Contains twenty-two muscles.



*labialis, super-maxillo-nasalis magnus, super-maxillo-nasalis parvus, transversalis nasi, super-nasalis labialis, maxillo-labialis, quadratus menti, levator menti, and depressor alae nasi.* All these, with the exception of the *orbicularis, transversalis nasi,* and the *levator* and *quadratus menti,* are in pairs.

*Dissection.*—To prepare the orbicularis, the skin and mucous membrane covering the lips with the subcutaneous glands, must be removed with the scissors, care being taken that the muscle is uninjured.

Form, situation, and structure.

Attachments.

Relations of superior half.

Relations of inferior half.

Action.

Position.

*Orbicularis oris,* (labialis, Gir.)—(Fig. 176, No. 1.)—This is a true sphincter muscle, made up of two semioval portions, a superior and an inferior, which form the chief bulk of the corresponding lips. These join at the angles of the mouth, where the fibres of the upper are interlaced with those of the lower. It is formed of deep red muscular fibres intimately *attached* to the skin, especially towards the angles of the mouth, but having no direct bony insertion. Some of these completely encircle the orifice of the mouth, while others seem continuations of various muscles, as the alveolo-labialis, super-nasalis labialis, super-maxillo-nasalis magnus, &c.

The superior portion responds internally to the buccal mucous membrane and a layer of salivary glands; externally, to the skin, to which it is intimately connected, except at its median part, where it is separated from it by the aponeurosis of the super-maxillo-labialis, and some fibres which homologate in the upper lip the levator menti of the lower. The inferior portion is related internally to the buccal mucous membrane and some small salivary glands; externally, to the integument to which it is attached.

The orbicularis closes the mouth after the manner of other sphinctors. It concurs also with the surrounding muscles in the performance of those complex labial movements necessary in the suction of liquids, the prehension of aliments, and mastication.

*Dissection.*—To prepare the alveolo-labialis, remove the skin from the side of the face, dissect off the facial portion of the panniculus, and carefully raise the zigomato-labialis, and the anterior portion of the masseter, from the surface of the muscle. It may afterwards be bisected along its median tendinous intersection, and dissected away from the mucous membrane, that its alveolar insertions may be observed.

*Alveolo-labialis,* (molaris externus et internus, Bourg., buccinator.)—Situated on the side of the face, outside the molar teeth, and partially covered by the zigomato-labialis, and the anterior portion of the



masseter, the alveolo-labialis is a thin, flat muscle, elongated in the direction of the jaws, and penniform in its posterior half. It is formed of a superficial and a deep layer.

Two layers.

The deep layer, longer and narrower than the superficial, is penniform, with its fibres diverging from a median tendon forwards, and upwards or downwards towards the upper or lower jaws. Its fibres, which are partly aponeurotic, are *attached* posteriorly upon the alveolar tuberosity, and external aspect of the superior maxillary bone above the last three molars; also to the anterior border of the lower jaw between the last molar and the condyle. At its anterior extremity its fibres are lost among those of the orbicularis.

Deep layer.

Its form and structure.

Origin.

Termination.

The superficial layer, less tendinous than the deep, entirely covers the anterior half of the latter. Its fibres extend from the median tendon of the deep, upwards and downwards, to be inserted above on the external surface of the superior maxillary bone, above the superior interdental space and first molar tooth; below, on the inferior maxilla beneath the interdental space. In front of the median raphe, the deep and superficial parts are easily separated, but behind this the separation is difficult, except where they are divided by two large venous trunks.

Superficial layer.  
Structure and attachments.

It responds externally to the super-maxillo-nasalis magnus, super-nasalis labialis, zigomato-labialis, panniculus, and masseter, with the facial artery and veins, and the Stenonian duct which pierces this muscle to gain the mouth. It is covered internally by the buccal mucous membrane. At the anterior and posterior parts of its upper border lie the corresponding molar glands.

Relations.

The alveolo-labialis is chiefly brought into play during the process of mastication. Its attachments on the superior and inferior maxillary bones enables it to assist in closing the mouth, but it is chiefly useful in preventing the collection of pellets of food outside the gums, and, along with the tongue, in retaining such between the molar teeth.

Action.

*Zigomatico-labialis*, (part of the panniculus of Bourgelat; zigomaticus major of man).—This is a minute muscular band, very thin, and composed of fibres of a pale red colour, which have a downward and forward direction. It *originates* beneath the maxillary spine, on the surface of the masseter, by an aponeurosis, common also to the panniculus, and *terminates* on the surface of the alveolo-labialis, behind the angle of the mouth. Its external surface responds, and is intimately adherent to the skin, while its internal aspect is related to

Form and direction.

Origin.

Insertion.

Relations.

**Action.** the masseter, the alveolo-labialis, several molar glands, the Stenonian duct, the facial artery, and some nervous twigs. This muscle retracts the angle of the mouth, and slightly corrugates the skin of the face.

**Position, form, and structure.**

*Lachrymo-labialis*, (lachrymalis).—Situating subcutaneously in front of the eye, the lacrymalis is a flat, thin, irregularly triangular muscle, composed of pale red fibres. These extend from the inner canthus of the eye downwards and forwards, to lose themselves in a subcutaneous fascia on the middle of the cheek. In certain cases, some of its fibres pass under the *zigomato-labialis*, constituting a muscle corresponding to the *zigomaticus minor* of man.

**Attachments.**

**Relations.**

The lachrymalis is related externally to the skin, and internally, to the super-maxillo-labialis; it is continuous above with the super-nasalis-labialis, behind with the orbicularis palpebrarum, and below with the panniculus. Its action seems to be to corrugate the skin in front of the eye.

**Action.**

*Super-nasalis-labialis*, (maxillaris, Bourg.; levator labii superioris alæque nasi, of man).—Placed upon the side of the face, in a direction from above downwards, forwards, and outwards, this is a thin, flat, and irregularly quadrilateral muscle, aponeurotic at its origin, and divided anteriorly into two parts, between which passes the super-maxillo-nasalis.

**Position.**

**Form.**

**Origin.**

It arises from the dorsal aspect of the nasal and frontal bones, where it joins in the median line with its fellow on the opposite side.

**Insertion.**

Its *insertion* takes place by its superior or largest division upon the external ala of the nose and the upper lip, where it is confounded with the orbicularis; its inferior division becomes confounded with the orbicularis at the angle of the mouth.

**Relations.**

Responding externally to the skin, and by its supero-anterior division to the super-maxillo-nasalis major, this muscle covers the super-maxillo-labialis, the posterior portion of the two super-maxillo-nasales, some nerves and vessels. It retracts the angle of the mouth, and raises the external ala of the nose and the upper lip.

**Action.**

**Exposure.**

**Position.**

**Form and structure.**

*Super-maxillo-labialis*, (levator labii superioris).—In order to expose this muscle, the super-nasalis-labialis must be cut across and reflected backwards. Placed in an antero-posterior direction upon the side of the face, it is composed of a conical fleshy body, terminated in front by a long flattened tendon.

**Origin.**

It arises from the external surface of the superior maxillary and molar bones, and becoming tendinous above the false nostrils, joins

its fellow on the median line, to form a single flattened tendon, which terminates in the subcutaneous tissue of the upper lip.

Insertion.

Contiguous structures.

Covered by the lacrymalis and super-nasalis-labialis musele, it covers in turn the superior maxillary bone, the false nostril, the transversalis nasi, and the orbicularis oris. It raises the upper lip, and if one only acts, turns it also to a side.

Action.

*Super-maxillo-nasalis magnus*, (pyramidalis-nasi, Bourg.; caninus of man).—This is a small muscle, placed on the lateral aspect of the face, between the two branches of the super-nasalis-labialis. It is elongated from before backwards, flattened and triangular, with its somewhat tendinous apex posteriorly.

Situation.

Direction and form.

It originates from before the superior maxillary spine, and is inserted into the skin over the external ala nasi, along with the upper branch of the super-nasalis-labialis; some of its lower fibres go to the orbicularis.

Origin.

Insertion.

It responds externally to the super-maxillo-labialis and skin; internally to the superior branch of the muscle just named, to the pes anserina, and superior labial artery.

Relations.

It pulls outwards the external ala nasi, and dilates the nostrils.

Action.

*Super-maxillo-nasalis parvus*, (nasalis brevis, and part of the pan-niculus of Bourgelat).—This is composed of two pale, thin, museular bands, extended respectively along the two sides of the angle formed by the superior prolongation of the anterior maxillary bone and the nasal spine, and only joining each other posteriorly. They originate in common from the union of the superior and anterior maxillary bones.

Form and situation.

Origin.

The superior portion, formed of small, fleshy, and tendinous bundles, which join in the median line with those of the musele on the opposite side, is inserted on the skin of the false nostril, the apex of the superior turbinated bone and the transversalis nasi, with which it becomes confounded. The inferior portion, the larger, is composed of a series of short fleshy bundles, intermixed with adipose tissue, which extends forwards and inwards along the course of the intermaxillary bone, to be inserted on the skin of the false nostril and the cartilaginous appendix of the inferior turbinated bone. Some of its fibres join those of the depressor ala nasi. The superior portion is separated from the skin by a fascia, and the super-maxillo-labialis tendon; the inferior by the super-nasalis-labialis. It dilates the nasal cavity and the false nostril.

Superior portion.

Its insertion.

Inferior portion.

Its insertion.

Relations.

Action.

*Transversalis-nasi*.—Placed on the superior aspect of the cartila-

Position.



Form, structure, and attachments.	ginous alæ of the nose, this is a single small and flattened quadrilateral muscle, the fibres of which run transversely from one cartilage to the other. It is entirely fleshy, and sends some of its lower fibres
Relations.	into the orbicularis oris. Responding inferiorly to the cartilages on which it is attached, it is covered by the tendinous expansion of the
Office.	super-maxillo-labialis. By raising and approaching the internal alæ to each other, it dilates the nostrils powerfully.
Situation, form, and structure.	<i>Maxillo-labialis</i> , (depressor-labii-inferioris, Rigot; triangularis oris in man).—Placed along the lower margin of the alveolo-labialis, the maxillo-labialis consists of a flattened, fleshy body, terminating on a level with the mental foramen in a rounded tendon, which expands
Origin.	on the lower lips. It <i>originates</i> along with the alveolo-labialis from
Insertion.	the alveolar border of the lower jaw, and is <i>inserted</i> by expanded tendon on the skin of the lower lip.
Relations.	Responding externally to the panniculus and masseter, it is related internally to the alveolo-labialis and inferior maxillary bone.
Action.	It depresses the lower lips, and, unless when acting in concert with its fellow, pulls it to one side.
Situation.	<i>Mento-labialis</i> .—This is a single muscle, placed on the antero-inferior aspect of the symphysis menti. Its fibres, which are very short,
Attachments.	extend from their <i>origin</i> on the sides of the symphysis, to be <i>inserted</i> on the skin of the lower lip and the inferior half of the orbicularis
Relations and action.	oris. It is covered on each side by the expanded tendon of the maxillo-labialis, and is confounded at its lower border with the levator menti. It assists in opening the lower lip.
Form and position.	<i>Levator menti</i> , (medius posterior, Bourg.)—This is a small, flattened muscular bundle, placed on the antero-inferior aspect of the chin,
Origin.	where it is covered by the muscle last described. It takes its <i>origin</i> from the external surface of the lower jaw, just beneath the middle
Insertion.	and corner incisors, and is <i>inserted</i> into the substance of the lip, having previously united with its fellow on the opposite side. It acts
Action.	powerfully in opening the lower lip.
Dissection.	<i>Depressor alæ nasi</i> , (medius anterior, Bourg.; myrtiformis in man).—To expose this muscle, the upper lip should be raised, and the mucous membrane carefully dissected off. It is a small muscle,
Form and situation.	deeply situated on the anterior aspect of the anterior maxillary bone.
Origin and insertion.	The fibres take their <i>origin</i> just above the alveolar border, and extend upwards to be <i>inserted</i> on the inferior turbinated bone, along with the super-maxillo-nasalis parvus. Some of its fibres go into the substance
Office.	of the upper lip. This is a dilator of the anterior nares.

*Differences in these fascial muscles :—*

In *ruminants*, the *orbicularis* and *alveolo-labialis* resemble those *Ruminants*.  
of the horse.

The *zigomato-labialis*, thicker and of a deeper colour, originates by aponeurosis as far back as the zygomatic process of the temporal bone.

The *lachrymalis* is broader, thicker, and possessed of a deeper colour than in solipedes. At its origin, it is nearly confounded with the *orbicularis palpebrarum*, from which its anterior fibres run forwards under the *zygomaticus*, to expand on the surface of the *alveolo-labialis*, while its posterior run under the former muscle, to spread out on the surface of the *panniculus*.

The *super-nasalis-labialis*, continuous above with the *panniculus* covering the frontal bone, has its supero-anterior division running over, in place of under, the *super-maxillo-nasalis parvus* and *super-maxillo-labialis*; the posterior division, a minute band, passes beneath these muscles, to lose itself on the substance of the upper lip.

The *sheep* is destitute of this muscle.

The *super-maxillo-labialis* is represented by three individual muscles placed one above another, and each terminating by a tendon. That of the superior passes over the median line, while those of the two others pass along the margin of the external *alæ nasi* to gain the upper lip; between the latter passes the *super-maxillo-nasalis magnus*. The only peculiarity of the latter muscle is its passage between these tendons.

No *super-maxillo-nasalis parvus* nor *transversalis nasi* exist.

The *mento-labialis*, larger and more deeply coloured than in the horse, is continuous posteriorly with the two *levators menti*.

The *pig* has no *lachrymalis*, *super-nasalis-labialis*, nor *transver-* fig.  
*salis nasi*.

The *super-maxillo-labialis*, larger than in the horse, takes its origin from the fossa in front of the orbit, and terminates in the centre of the snout, by a tendon which unites with that on the opposite side.

The *super-maxillo-nasalis magnus*, large and thick, is formed of two portions, which originate from the fossa in front of the orbit, and the tubercles replacing the maxillary spine; the superior portion is attached by a number of minute tendinous fibres to the snout, and the external *ala* of the nose; the inferior portion, by similar prolongations, to the upper lip, where it unites with the tendon of the *super-maxillo-labialis*.

The *super-maxillo-nasalis parvus* is relatively more bulky than in the horse, and its superior portion unites with the tendon of the super-maxillo-labialis.

The *mento-labialis*, large, and of a deep red colour, terminates by tendinous fibres.

Dog and cat. In *carnivora*, the *orbicularis oris* is little developed.

The *alveolo-labialis* is very thin, and is not divided into two layers.

The *zigomato-labialis*, continuous above with the zigomato-auricularis, acts on the scutiform cartilage and the angle of the mouth.

The *lachrymalis* is represented by a few fibres only.

The *super-nasalis-labialis*, large, broad, and not divided inferiorly, is continuous above with the panniculus over the forehead, and terminates on the upper lip.

The *super-maxillo-labialis* is fused with the *super-maxillo-nasalis magnus*, which extends from above the infra-orbital foramen, to the external ala of the nose and the upper lip.

The *super-maxillo-nasalis parvus* and the *transversalis nasi* are wanting.

The *maxillo-labialis* is a narrow band, detaching itself from the inferior border of the alveolo-labialis.

The *depressor alae nasi* is well developed.

The *mento-labialis* and *levatores menti* are very thin and pale.

#### TEMPORO-MAXILLARY REGION.

Contains five muscles. This region comprises five muscles, arranged around, and destined to move, the temporo-maxillary joint. These are the *masseter*, *temporalis*, *pterygoideus externus*, *pterygoideus internus*, and *stylo-maxillaris*.

*Dissection*.—To expose the masseter, it is only necessary to remove the skin and panniculus from the side of the jaws.

Situation and form. *Masseter*, (zigomato-maxillaris, Gir.)—(Fig. 176, No. 2.)—Situated on the side of the lower jaw, the masseter is a short, but broad and thick muscle, flattened from within outwards, and irregularly quadrilateral.

Structure. It is divided by aponeurotic intersections into a series of layers, the fibres of which run in different directions, as is well seen at the posterior border of the muscle. These tendinous intersections, together with a strong aponeurotic covering possessed by this muscle, diminish in thickness from above downwards, and from before backwards.

Origin. *Originating* from the lower aspect of the superior maxillary spine and zigoma, as far back as the mastoid process, it is *inserted* on the



outer aspect and inferior border of the posterior half of the inferior maxillary bone on that side.

This muscle is covered by the panniculus of the face, branches of the portio-dura, and several arterial and venous trunks. It responds internally to the inferior maxillary bone, the alveolo-labialis, and maxillo-labialis muscles, the greater part of the superior molar glands, portion of the temporo-maxillary articulation, and a large venous trunk; in front of the joint it adheres very intimately to the temporalis. Its anterior border is related to the facial artery and vein, and the Stenonian duct; its posterior to the parotid gland. Relations.

The masseter powerfully raises the lower jaw, and is especially useful during mastication. Action.

*Differences.*—In *ruminants* this muscle is thinner and less tendinous. In *carnivora*, on the other hand, it is of great size and strength. Ruminants.

*Dissection.*—To prepare the temporal, the anterior, and internal auricular muscles, and scutiform cartilage, must be removed, together with the globe and muscles of the eye; the orbital process of the frontal must be sawn through at its two extremities, and taken away.

*Temporalis*, (temporo-maxillaris, Gir.)—Placed in the temporal fossa, which it nearly fills, this muscle is moulded on the occipital and parietal bones. It is short, flat, and radiating, intersected by tendinous layers, and covered by a shining aponeurosis, which increases in strength towards its lower insertion. Situation and form.  
Structure.

It arises from the whole temporal fossa, with the bony crest surrounding it; also, by a large and lighter-coloured bundle, from the asperities above the margin of the orbital hiatus. Its fibres converge to be inserted on the coronoid process and anterior border of the lower jaw. Origin.  
Insertion.

It is related externally to the temporo-auricularis and scuto-auricularis internus muscles, to the scutiform cartilage, the fatty pad at the base of the ear, and in the orbit to the adipose tissue surrounding the ocular apparatus. Its internal aspect responds to the temporal fossa, and by the orbital bundle to the pterygoidei muscles. Relations.

This muscle acts with the masseter in closing the jaws; its posterior fibres also assist in pulling the lower jaw backwards, while its anterior or orbital bundle turns it to one side. The temporalis accordingly assists in all the movements of the lower jaw in mastication. Action.

*Dissection.*—To expose the pterygoidei museles, the zygomatic arch may be taken away by sawing it through at its two extremities; the ramus of the lower jaw may then be sawn through in front of the molar teeth, and also just beneath the condyle and coronoid process; next by pulling the isolated portion of the ramus upwards, the pterygoideus internus may be observed on its inner aspect, and the pterygoideus externus still *in situ*, extending from the base of the brain to the neck of the coronoid process.

*Situation.* *Pterygoideus internus*, (part of the spheno-maxillaris of Bourgelat).—(Fig. 188, Nos. 1, 1.)—Placed in the intermaxillary space, and holding a position on the inner, very similar to that of the masseter on the outer aspect of the lower jaw, this muscle has been frequently described as an *internal masseter*.

*Origin.* Taking its *origin* from the spheno-palatine crest and the pterygoid process of the sphenoid, the pterygoideus internus is *inserted* in the great concavity inside the ramus of the lower jaw.

*Contiguous parts.* It responds externally to the inferior maxillary bone, the pterygoideus externus, the orbital bundle of the temporalis, and the inferior dental, hyoidean, and lingual vessels and nerves. Its internal aspect is related to the tensors palati, hyoideus magnus, digastrius, the hyoglossus longus, the hyoglossus brevis, the guttural pouch, hyoid bone, laryngo-pharangeal apparatus, the hypoglossal and glosso-pharangeal nerves, the facial artery and vein, with the Stenonian duct, and the submaxillary gland.

*Action.* This musele raises the lower jaw, and turns it to one side.

*Ruminants.* *Differences.*—In *ruminants*, this musele is inseparable from the pterygoideus externus, both taking their origin near the median line of the cranium, so that they can effect a more active lateral motion.

*Pterygoideus externus*, (portion of the spheno-maxillaris of Bourgelat).—(Fig. 188, No. 11.)—Placed in front of the temporo-maxillary articulation, this is a short conoid muscle, composed of fleshy and tendinous fibres, which, *originating* from the inferior aspect of the sphenoid and its pterygoid process, outside the origin of the *internus*, run downwards and backwards to be *inserted* on the neck of the condyle of the lower jaw.

*Relations.* Related externally to the orbital portion of the temporalis and the temporo-maxillary articulation, it responds internally to the pterygoideus internus, tensors palati, and the branches of the inferior maxillary division of the fifth cranial nerves.

*Action.* Acting singly, the pterygoideus externus brings the lower jaw forwards, and turns it to one side; with its fellow, it simply advances the jaw.

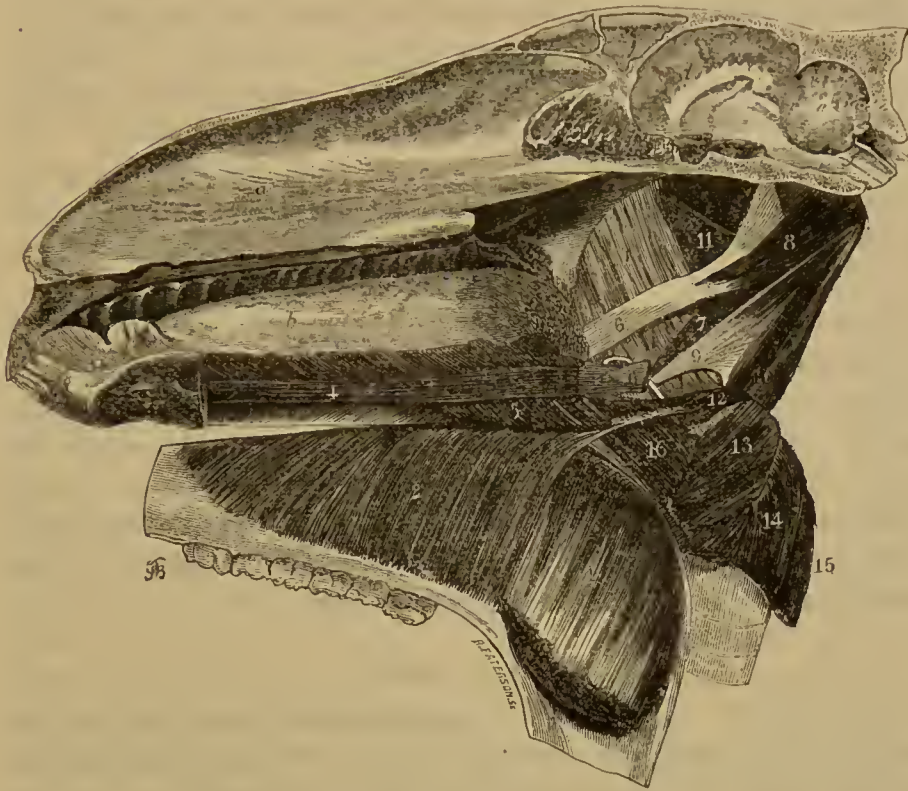


Fig. 188.

DRAWING OF THE HEAD, SHOWING THE MUSCLES IN THE INTERMAXILLARY SPACE.

- |                                      |  |
|--------------------------------------|--|
| 1 1. Pterygoideus internus.          | 12. Median constrictor of the pharynx. |
| 2. Mylo-hyoideus.                    | 13 14. Posterior constrictor of same.  |
| 3. Genio-hyo-glossus.                | 15. Commencement of the œsophagus.     |
| 4. Hyo-glossus longus.               | 16. Hyo-thyroideus.                    |
| 5. Hyo-glossus brevis.               | a. Septum nasi.                        |
| 6 6. Large cornua of the hyoid bone. | b. Tongue.                             |
| 7. Hyoideus magnus.                  | c. Ethmoid cells.                      |
| 8. Stylo-hyoideus.                   | d. Cerebrum.                           |
| 9. Digastricus.                      | e. Cerebellum.                         |
| 10. Stylo-maxillaris.                | f. Medulla oblongata                   |
| 11. Pterygoideus externus.           |  |



Situation, form, and structure.	<i>Stylo-maxillaris</i> , (portion of the stylo-maxillaris of Girard, and digastricus of Chauveau).—(Fig. 188, No. 10.)—Situated behind the posterior border of the lower jaw, this is an elongated and somewhat pyramidal muscle, with its apex superiorly. It is intersected by several tendinous layers, and covered by a thick fibrous aponeurosis.
Origin.	It <i>arises</i> along with the superior belly of the digastricus from the
Insertion.	external aspect of the styloid process of the occiput, and is <i>inserted</i> on the posterior border of the lower jaw at its angle.
Relations.	It responds externally to the parotid gland and tendon of the sterno-maxillaris; internally, to the guttural pouch, pharynx, digastricus, hyoideus magnus, and facial artery. To the digastricus it is inseparably united.
Action.	This muscle depresses the lower jaw and pulls it backwards.
Ruminants.	<i>Differences</i> .—In <i>ruminants</i> this muscle takes its insertion on the inferior border of the lower jaw, in front of the fissure for the facial artery. Some transverse fibres, running from the muscle on the one side to that on the opposite, raise the hyoid bone and larynx, during their contraction, in the same manner as the digastricus of the horse.
Fig and carnivora.	In the other domestic quadrupeds this muscle is inserted on the lower jaw, in the same manner as in ruminants.

## HYOIDEAN REGION.

Contains thirteen muscles. This region is composed of six muscles, arranged in pairs, and one single. The former are the *digastricus*, the *mylo-hyoideus*, the *genio-hyoideus*, the *hyoideus magnus*, the *hyoideus parvus*, and the *stylo-hyoideus*. The latter is the *transversalis hyoidei*.

*Dissection*.—To observe them properly, the subject should be placed upon his back and the head extended, to put the muscles on the stretch. They are at once exposed on removing the skin, the panniculus, and the subcutaneous fascia.

Form.	<i>Digastricus</i> , (portion of the digastricus of Chauveau, or of the stylo-maxillaris of Girard).—(Fig. 188, No. 9.)—As its name would indicate, this muscle is formed of two fleshy bellies, separated from each other by a median tendon. It <i>originates</i> , along with the stylo-
Origin.	maxillaris, from the styloid process of the occiput, and is <i>inserted</i> ,
Insertion.	by tendinous fibres, on the inferior straight border of the lower jaw.
Direction and pulley of hyoideus magnus.	The muscle describes a curve, with its concavity turned upwards, in consequence of its median tendon playing through a ring in that of the hyoideus magnus.
Relations.	The superior belly is related internally to the submaxillary gland, larynx, and pharynx; externally, it is inseparable from the stylo-

maxillaries. Its inferior belly responds externally to the ramus of the lower jaw, and internally to the mylo-hyoideus muscle.

The digastricus depresses the lower jaw, and raises the hyoid bone and larynx. Action.

*Differences.*—No such muscle exists in the other domestic quadrupeds. Absent in other domestic animals.

*Mylo-hyoideus.*—(Fig. 188, No. 2.)—Placed superficially between the branches of the lower jaw, this is a thin elongated muscle, broader posteriorly than anteriorly, and uniting in the median line with that on the opposite side. It is entirely formed of muscular fibres, which run inwards and backwards from the ramus of the lower jaw. Situation and form.

It arises inside the alveoli of the molar teeth from the mylo-hyoid ridge, and is inserted—1st, On the median fibrous raphe, by which it joins its fellow, and which extends from the anterior appendix of the hyoid bone to the symphysis menti; 2nd, To the anterior appendix and lower aspect of the body of the hyoid bone. Origin. Insertion.

The mylo-hyoideus responds inferiorly to the digastricus, inferior maxillary bone, and the submaxillary lymphatic glands. It is related superiorly to the buccal mucous membrane, sublingual gland, Whartonian duct, lingual nerve, the genio-hyoideus, genio-glossus, hyoglossus longus, and hyo-glossus brevis. Its posterior border is related to the pterygoideus internus. Relations.

It draws forwards the os-hyoides, tongue, and larynx, in the act of deglutition. By its union with its fellow, along the whole median line, it also forms a support for the tongue. Action.

*Differences.*—In ruminants this muscle is partially divided into two layers, an arrangement which exists to a lesser extent in the horse. Ruminants.

*Genio-hyoideus.*—(Fig. 188, No. 3.)—Situated above the last muscle in the median line, between the symphysis of the lower jaw and the spur process of the hyoid bone; the genio-hyoideus is long, fusiform, tendinous at its extremities, especially the anterior, and in union with its fellow on the median line. Position and form.

It originates from the inferior border of the lower jaw, close to the symphysis, and is inserted on the anterior appendix of the hyoid bone. It responds inferiorly and externally to the mylo-hyoidens, internally to its fellow, and superiorly to the genio-glossus. Origin. Insertion. Relations.

This muscle pulls the hyoid bone forwards and downwards. Action.

*Hyoides magnus*, (kerato-hyoideus magnus, Gir.)—(Fig. 188,

Position, form, and structure.	No. 7.)—Placed along the posterior border of the large cornu of the os-hyoides, this is a slender and fusiform muscle, with tendinous extremities. Its lower tendon is perforated for the passage of the median tendon of the digastricus. It is <i>attached</i> superiorly to the posterior border of the large cornu at its angle, and inferiorly to the lower aspect of the posterior branch on the same side.
Origin and insertion.	
Relations.	The hyoideus magnus responds externally to the pterygoideus internus; internally, to the guttural pouch, pharynx, and lingual nerve. Along its inferior border lies the superior belly of the digastricus; along its superior, the facial artery and glosso-pharyngeal nerve.
Action.	It pulls the body of the hyoid upwards and backwards.
Cow and pig. Dog.	<i>Differences.</i> —This muscle has no ring for the passage of the digastricus, except in solipedes. In <i>ruminants</i> and in the <i>pig</i> it has a long slender tendon superiorly, but none inferiorly. In <i>carnivora</i> it is a true <i>temporo-hyoides</i> , being prolonged by a long delicate tendon to the mastoid portion of the temporal bone.
Form and position. Attachments.	<i>Hyoideus parvus</i> , (kerato-hyoides parvus, Gir.)—This thin, flat, triangular muscle fills up the space between the small cornu of the os-hyoides and its posterior branch. Its fibres extend from the posterior border of the small cornu, and from the lower end of the large, backwards and downwards to the branch of the bone. It responds externally to the hyo-glossus brevis and lingual artery; internally, to the pharyngeal mucous membrane. This muscle approaches the superior cornu to the body of the hyoid.
Relations, and office.	
Dog.	<i>Differences.</i> —In <i>carnivora</i> this muscle is relatively large, and contains some tendinous fibres.
Form and situation.	<i>Stylo-hyoides</i> .—(Fig. 188, No. 8.)—This is a small, flattened, triangular muscle, situated between the styloid process of the occiput and the posterior border of the large cornu of the os-hyoides. It is composed of fleshy and tendinous fibres, which extend from the anterior aspect of the styloid process, downwards and forwards to the perpendicular part of the posterior border of the large cornu. Confounded at its origin with the stylo-maxillaris and digastricus, its outer surface is related to the parotid gland, and its inner to the guttural pouch. Acting as a lever upon the larger cornu, it pulls the hyoid bone backwards and downwards.
Structure and attachments.	
Relations.	
Action.	
Ox and dog.	<i>Differences.</i> —In <i>ruminants</i> the stylo-hyoides is inserted on the internal aspect of the large cornu. In the <i>carnivora</i> it is very small, or altogether wanting.
	<i>Transversalis hyoideus</i> .—This name has been given to some muscular



fibres, extending between the superior extremities of the small cornua, and which tend to approach these to each other. This is absent in carnivora.

## LINGUAL REGION.

Five pairs of muscles exist in this region. These are the *hyo-glossus longus*, *hyo-glossus brevis*, *genio-glossus*, *lingualis*, and *pharyngo-glossus*. Contains five pairs of muscles.

In studying these muscles, the tongue should be drawn forwards with a hook, in order to put them on the stretch.

*Hyo-glossus longus*, (kerato-glossus, Gir.; part of the *hyo-glossus* of man).—(Fig. 188, No. 4).—Extended along the whole length of the external aspect of the tongue, this is a narrow band of bright red muscular fibres, running parallel to each other. It *arises* by a thin aponeurosis from the external aspect of the large hyoid cornu, towards its lower extremity, and *terminates* at the tip of the tongue, its fibres becoming mixed up on the lower aspect of that organ with those of the adjacent muscles, and of its fellow on the opposite side. Position, form, and structure. Origin. Termination.

It responds externally and inferiorly to the mylo-hyoideus, the lingual nerve, the sublingual gland, the Whartonian duct, and in its anterior portion to the buccal mucous membrane. It is related internally to the *hyo-glossus-parvus*, and *genio-glossus*. Relations.

The *hyo-glossus longus* contracts the tongue, pulling it within the mouth, draws it downwards, or to one side. Action.

*Hyo-glossus-brevis*, (*basio-glossus*, *hyo-glossus*).—(Fig. 188, No. 5).—Situating on the lateral aspect of the tongue, on the inner side of the *hyo-glossus longus*, this muscle is at once thicker and broader than the last, and formed of fibres running upwards and forwards in a somewhat radiating direction. *Originating* from the external surface of the body and posterior branch of the hyoid bone, as far back as the articulation with the lesser cornu, its fibres spread out on the whole lateral aspect of the tongue, and turn inwards, intermixing with and crossing the direction of the other muscles especially towards the superior aspect of that organ. Situation, form, and direction. Origin and termination.

It responds externally to the mucous membrane, the *hyo-glossus longus*, and mylo-hyoideus, with the lingual nerve and Whartonian duct; internally, to the *genio-glossus*, the *pharyngo-glossus*, the lingual artery, the branches of the glosso-pharyngeal nerve, and at its posterior extremity to the *hyoideus parvus* and small hyoid cornu. Relations.

Its action is like that of the *hyo-glossus longus*.

Action.

Form and situation. Structure. Origin and termination.	<i>Genio-glossus</i> , (genio-hyo-glossus, Per.)—(Fig. 188, No. 3.)—This is a broad flat muscle, situated in the infero-median part of the tongue. It is composed of muscular fibres, <i>originating</i> anteriorly from a tendon, and radiating in an upward and backward direction, to gain the superior aspect of the organ. Its tendon is <i>attached</i> close to the symphysis menti, along with that of the genio-hyoideus, and its fibres ramify in a longitudinal direction on the whole superior surface of the tongue. It is related by its external aspect to the genio-hyoideus and hyo-glossi muscles, the mucous membrane of the frenum lingui, the sublingual gland, lingual artery, and several nervous twigs. Its internal aspect responds to its fellow, except at its tendinous part, which is separated from the other by adipose tissue. According to the part of this muscle called into action, the tongue will be drawn forwards, backwards, or downwards. If only one acts, it will pull it to one side.
Relation.	
Action.	
Form and position.	<i>Lingualis</i> , (hyo-glossus parvus, Ch.)—This is a flattened mass running along the superior surface of the tongue, and easily exposed by dissecting off the mucous membrane and glandular tissue covering that part. It <i>originates</i> from the superior aspect of the body and posterior branch of the hyoid bone, and running along the superior aspect of the tongue, its fibres turn in various directions, to be confounded with those of the other lingual muscles. Surrounded at their origin by a large mass of adipose tissue, the two muscles are enclosed at their median part between the two hyo-glossi longi.
Origin and course.	
Relations.	
Action.	This muscle will draw the tongue backwards, contracting that organ.
Form, structure, and attachments.	<i>Pharyngo-glossus</i> , (palato-glossus in man).—A small muscle, the fibres of which run parallel to each other, from their origin on the lateral aspect of the pharynx, into the substance of the tongue. Passing outside the articulation between the cornua of the os-hyoides and between the genio-glossi muscles, its fibres plunge into the substance of the latter and lose their identity.

## PHARANGIAL REGION.

Muscles of the pharynx.

This region contains the following muscles:—*Constrictor pharyngeus anterior*, *constrictor pharyngeus medius*, *constrictor pharyngeus posterior*, *hyo-pharyngeus*, *palato-pharyngeus*, and sometimes a small muscle, the *aryteno-pharyngeus*.

*Dissection.*—The trachea and œsophagus should be cut through below the larynx, and the loose connective tissue attaching them to the anterior aspect of the cervical vertebra cut through. The head may then be separated from the

neck, and the posterior portion of the cranium removed, by sawing from below upwards on a level with, or just behind the temporo-maxillary articulation. The pharynx may be stuffed with tow to put the muscles on the stretch.

*Constrictor pharangeus anterior*, (pterygo-pharangeus, Gir.) — This is a broad, thin, flattened triangular muscle, situated on the superior aspect of the pharynx. *Originating* from the pterygoid process, some of the fibres take a backward and some a forward direction; the posterior fibres commingle with those of the palato-pharangeus, and the anterior running down the lateral aspect of the pharynx unites with those of its fellow in the median line below. The latter form a circle round the origin of the Eustachian tube. The muscle bears on its outer aspect a layer of yellow elastic tissue, which extends from the pterygoid process downwards, to be attached to the hyoid bone and thyroid cartilage. This layer acts as a passive opponent of the constrictor muscles.

Form and position.

Origin.

Different courses of its fibres.

Their termination.

Elastic covering.

This muscle acts as a constrictor of the pharynx in both its longitudinal and transverse diameters. Action.

*Constrictor pharangeus medius*, (hyo-pharangeus, Gir.)—(Fig. 188, No. 12.)—This is a small flattened band, which takes its *origin* from the antero-internal part of the posterior branch of the hyoid bone, and meets its fellow in the median raphe above the pharynx. This muscle covers the superior constrictor, the hyo-pharangeus, and the palato-pharangeus. Its name indicates its action.

Form and attachments.

Relations.

*Constrictor pharangeus posterior*, (crieo-pharangeus and thyropharangeus of Gir.)—(Fig. 188, Nos. 13 and 14.)—This consists of two flattened muscular bands which homologate the *inferior constrictor* in man. They *arise* respectively from the supero-lateral aspect of the cricoid, and the lateral aspect of the thyroid cartilages; uniting with each other and with the median constrictor, they extend upwards to the superior aspect of the pharynx, where they form a common aponeurosis, and across the median raphe meet the corresponding muscles of the opposite side. All three are active constrictors of the pharynx.

Form.

Origin.

Course.

Termination.

Action.

*Differences.*—The posterior constrictor is a single muscle in the ox.

Ox.

*Hyo-pharangeus*, (kerato-pharangeus, Gir.; stylo-pharyngeus in man).—This is a flattened quadrilateral band, attached to the internal aspect of the large hyoid cornu, towards its superior extremity, and extending to the side of the pharynx, where its fibres commingle with those of the superior constrictor. In some subjects it receives

Form and attachments.



- Action.** fibres from the lower end of the cornu as well. It draws the walls of the pharynx upwards and outwards, when a pullet of food is being received into the latter.
- Double in ox.** *Differences.*—In the *ox* this muscle is formed of two portions, a superior and an inferior.
- The *palato-pharyngeus* will be described with the muscles of the palate.
- Form and situation.** *Aryteno-pharyngeus.*—A very slight band of muscular fibres, found in most subjects, and extending along the lower aspect of the pharynx, has been so named. It is *attached* to the posterior border of the arytenoid cartilage, and is lost towards the commencement of the œsophagus. It contracts the pharynx in its longitudinal diameter.
- Attachments and office.**
- Ox, dog, and pig.** *Differences.*—This muscle is well developed in the *ox*, and still more so in the *dog* and *pig*.

## PALATAL REGION.

- Three muscles on each side.** The soft palati contains three pairs of muscles, the *circumflexus palati*, the *tensor palati*, and the *palato-pharyngeus*.
- Form, structure, and position.** *Circumflexus palati*, (staphyleus, Gir.; palato-staphyleus, Ch.; azygos uvulæ in man).—This is a small cylindrical muscular mass, of a bright red colour, extending along the median line of the palate, where it is related to its fellow on the opposite side. It is *attached* anteriorly upon a strong fibrous membrane, occupying the anterior half of the palate, and attached round the posterior horizontal border of the palatine bones. It terminates at the posterior border of the soft palate. The *circumflexus palati* is related anteriorly to the mucous membrane, posteriorly to the *palato-pharyngeus*. It contracts the soft palate, and dilates the isthmus faucium.
- Attachments.**
- Action.**
- Origin.** *Tensor palati*, (stylo-staphylens, Gir.; peristaphylei externus et internus).—Taking its *origin* by tendon from the styloid process of the temporal bone, this muscle soon divides into two layers, an internal and an external, which may fairly be considered as individual muscles.
- Division.**
- Course of the external part.** The external is a slender band, flattened from side to side, and extended forwards to the pterygoid bone, round the pulley on the inner aspect of which it plays; in front of this it takes an outward direction, and expands, to be *inserted* on the posterior border of the fibrous layer of the soft palate.
- Insertion.**

The *internal layer*, (stylo-pharyngeus of Pereivall) is a thin muscular band, which leaves the external at the posterior border of the superior constrictor of the pharynx, to pass beneath that muscle; from this it runs forwards, beneath the mucous membrane of the pharynx, to expand on the inferior aspect of the palato-pharyngeus, with which it is extended to the soft palate. Internal layer; its form, course, and insertion.

The *external layer* responds to the pterygoidei muscles, the internal to the pharyngeal mucous membrane and the Eustachian tube. The former draws the velum palati downwards, rendering it tense, the latter acts with the palato-pharyngeus in elevating the posterior border of the same. Relations. Action.

*Palato-pharyngeus*, (pharyngo-staphyleus).—This muscle may be exposed by dissecting off the mucous membrane and glandular structure from the posterior aspect of the soft palate. It consists of a thin muscular plate, occupying the whole posterior half of the soft palate. *Attached* on the posterior border of the aponeurosis of the palate, and uniting with its fellow in the median line, this muscle takes an outward and downward direction, following the posterior curved border of the soft palate; arrived at the lateral border of the latter, it turns upwards and backwards on the inner aspect of the anterior constrictor of the pharynx, with which its fibres become in part blended; a few, however, are traceable to their *insertion* on the superior border of the thyroid cartilage. Preparation. Structure and position. Origin. Course. Insertions.

Covering the posterior aspect of the other palatal muscles, the palato-pharyngeus lies between the mucous membrane and the anterior constrictor in its pharyngeal portion. Relations.

It draws the posterior border of the soft palate upwards and backwards during the passage of food through the isthmus faucium. Action.

#### AURICULAR REGION.

Each ear is possessed of ten extrinsic muscles, arranged in two layers as follows:—In the superficial layer, the *zigomatico-auricularis*, *temporo-auricularis externus*, *scuto-auricularis externus*, *three cervico-auriculares*, and the *parotido-auricularis*; in the deep layer the *temporo-auricularis internus*, *scuto-auricularis internus*, and the *mastoido-auricularis*. Ten external muscles of the ear.

*Zigomatico-auricularis*, (attollens anterior).—Situated in front of the ear, this muscle is composed of two or three small muscular bands, united by connective tissue. It *originates* from the zygomatic process of the temporal bone by a short aponeurosis, which unites Situation and structure. Origin.

- anteriorly with the orbicularis palpebrarum muscle. Its superior fibres are *inserted* on the external border of the scutiform cartilage, and its inferior on the outer aspect of the base of the concha, where it is confounded with the parotido-auricularis and the scuto-auricularis externus.
- Insertions.**
- Relations.** Lying immediately subcutaneously, this muscle responds internally to the zygomatic process, temporalis, and parotid gland.
- Action.** It draws the ear forwards.
- Position, form, and structure.** *Temporo-auricularis externus*, (attollens maximus).—Placed subcutaneously over the temporalis, this is a thin flat muscle, with its fibres radiating forwards, inwards, and backwards, from the root of the ear. It takes its *origin* from the crest bounding the temporal region internally, by an aponeurosis which joins that of its fellow in its posterior third; from this it converges to be *inserted* by one part on the internal border of the scutiform cartilage, and by a small band covering part of this cartilage and the scuto-auricularis externus muscle, to the inner aspect of the concha. Responding externally to the skin, and internally to the temporalis and temporo-auricularis internus, this muscle is continuous by its posterior border with the cervico-auricularis superior, and by its anterior with the zygomatico-auricularis.
- Origin.**
- Insertion.**
- Relations.**
- Action.** It adducts the ear and draws it forwards, turning its opening in front.
- Form and attachment.** *Scuto-auricularis externus*, (anterior conchæ, Percivall).—A short, flattened muscle, generally composed of two bundles, extending from the external surface of the scutiform cartilage to the base of the concha on its inner aspect. Responding externally to the skin and the conchal prolongation of the temporo-auricularis externus, it covers in turn the scutiform cartilage and scuto-auricularis internus.
- Relations.**
- Action.** Transmitting from the scutiform cartilage the action of the temporo-auricularis externus, of which it may be supposed a dependence, this muscle rotates the concha, turning its opening inwards.
- Position, form, and attachments.** *Cervico-auricularis superior*, (portion of the retrahens).—Placed behind the ear, upon the side of the poll, this is a thin, flattened muscle, *attached* posteriorly on the cordiform portion of the ligamentum nuchæ, and anteriorly on the middle of the posterior aspect of the concha. Lying immediately under the skin, it partially covers the two next muscles. Its anterior border joins the temporo-auricularis externus. In contraction it draws backwards the conchal cartilage.
- Parts contiguous.**
- Action.**
- Form and attachment.** *Cervico-auricularis medius*, (part of retrahens).—Broader than the last, and taking its *origin* from the same point posteriorly, this muscle



is *inserted* by its anterior expanded portion on the outer aspect of the base of the concha. Covered by the cervico-auricularis superior and the skin, it responds internally to the next muscle and the parotid gland. It rotates the ear, turning the opening outwards and backwards.

Relations.

Action.

*Cervico-auricularis inferior*, (part of the retrahens).—Placed beneath the last muscle and the parotid gland, this muscle *originates* from the same point as the other cervico-auriculares, and is *inserted* on the outer aspect of the bulging base of the concha. Its *action* homologates that of the medius.

Position.

Origin and insertion.

Action.

*Parotido-auricularis*.—(Fig. 176, No. 5).—Extended from below upwards, on the outer aspect of the parotid gland and base of the ear, this is a flat muscle, especially thin and expanded towards its lower extremity. Intimately *attached* to the parotid gland, it is *inserted* superiorly on the outer aspect of the concha, just at the union of its two borders. It is covered externally by a thin layer of the panniculus. This is an abductor of the ear.

Direction, position, and form.

Attachments.

Action.

*Temporo-auricularis internus*, (attollens posterior).—Placed beneath the external muscle of the same name, and part of the superior cervico-auricularis, this is a bright red elongated triangular muscle. It extends from its *origin* on the median ridge on the dorsal aspect of the occipital bone, to be *inserted* by tendon on the internal aspect of the concha, close to the attachment of the cervico-auricularis superior. This is a direct adductor of the ear.

Position and form.

Origin.

Insertion.

Action.

*Scuto-auricularis internus*, (posterior conchæ).—Placed on the inner aspect of the root of the ear, beneath the scutiform cartilage and scuto-auricularis externus, this is a small muscle, formed of two bundles crossing each other at a very oblique angle. They take their *origin* from the inferior aspect of the scutiform cartilage, and are *inserted* on the posterior aspect of the concha, at its lower end. This muscle rotates the ear, turning its opening outwards and backwards.

Situation and form.

Origin.

Insertion.

Action.

*Mastoido-auricularis*.—Situated on the internal aspect of the auricular cartilage and base of the concha, this is a delicate muscular bundle, taking its *origin* from the margin of the hiatus auditorius externus, and its *insertion* on the base of the concha. By drawing the concha downwards, it tends to shorten the tube through which the sound is transmitted.

Situation and structure.

Insertions.

Action.

#### PALPEBRAL REGION.

In this region we find *three* muscles—the *orbicularis palpebrarum*, common to both eyelids, and *two levators* of the upper lid.

Three muscles on either side.

Form and position.	<i>Orbicularis palpebrarum</i> .—This a flattened sphinctor, surrounding the orbit, and covering the whole outer aspect of the fibrous membrane of the eyelids; it is covered by the skin to which it is intimately attached. Its fibres are <i>attached</i> to the lachrymal tubercle, and at the inner canthus of the eye divide into an upper, larger, and a lower smaller bundle, which go to the corresponding lids, and intermix with each other at the outer canthus.
Structure and attachment.	
Action.	Its <i>action</i> is to close the eyelids.
Form, direction, and attachment.	<i>Levator palpebrae superioris externus</i> , (corrugator supercilii; fronto-superciliaris).—A flat, thin, and narrow muscular band, running obliquely downwards and outwards from the superior aspect of the frontal bone to the orbicularis palpebrarum and skin of the upper eyelid near the inner canthus. It responds externally to the skin, and internally to the frontal bone, on a level with the supra-orbital foramen. This muscle raises the internal part of the upper eyelid, and corrugates the skin by which it is covered.
Relations.	
Actions.	The other <i>Levator</i> will be described with the orbital muscles.

## ORBITAL REGION.

Eight muscles in each orbital region.	This region contains eight muscles—the <i>levator palpebrae superioris internus</i> , the <i>posterior</i> , <i>superior</i> , <i>inferior</i> , <i>internal</i> , and <i>external recti</i> , and the <i>superior</i> and <i>inferior oblique</i> .
Position, form, and direction.	<i>Levator palpebrae superioris internus</i> , (orbito-palpebralis).—Lying between the rectus superior oculi and the orbit, this is a thin, narrow muscle, following the course of that last named. It <i>arises</i> from the orbit above and inside the optic foramen, and on the level of the lachrymal gland ends in a thin aponeurosis, which spreads out on the internal aspect of the fibrous layer of the eyelid, to be <i>inserted</i> on the whole tarsal cartilage.
Origin.	
Insertion.	
Action.	This muscle raises the upper lid, but only when the eye is present, that it may play over its superior aspect; otherwise it draws the anterior border of the lid backwards into the orbit.
Position.	<i>Rectus posterior oculi</i> , (retractor oculi).—(Fig. 189, Nos. 5, 5).—This muscle completely surrounds the optic nerve in its orbital portion. It has a small diameter posteriorly, where it <i>arises</i> from the margin of the optic foramen, but it expands anteriorly to take its <i>insertion</i> on the whole posterior third of the globe of the eye. It is composed of four secondary bundles, and is separated from the other recti muscles by adipose tissue.
Form, origin, and insertion.	
Structure and relations.	

The posterior rectus contracts the globe of the eye, and draws it Action.  
backwards within the orbit.

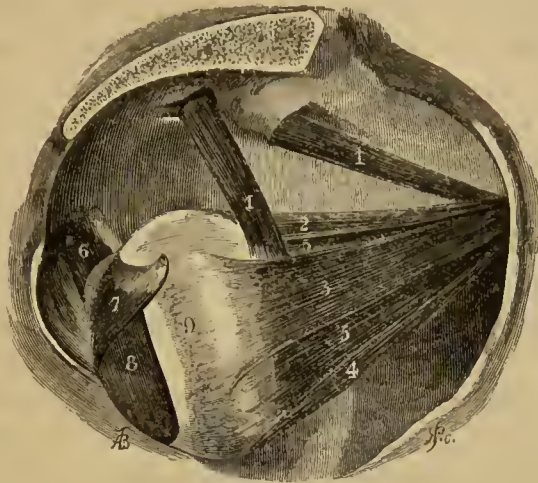


Fig. 189.—MUSCLES OF THE EYE-BALL.

- |                        |                        |
|------------------------|------------------------|
| 1 1. Superior oblique. | 6. Inferior oblique.   |
| 2. Superior rectus.    | 7. Membrana nictitans. |
| 3. External rectus.    | 8. Cornea.             |
| 4. Inferior rectus.    | 9. Sclerotic.          |
| 5 5. Retractor oculi.  |                        |

*Recti, superior*, (Fig. 189, No. 2); *inferior*, (Fig. 189, No. 4); *external*, (Fig. 189, No. 3); and *internal*, (levator, depressor, abductor, and adductor oculi).—In their arrangement these muscles resemble each other so much that a general description of them will suffice. Each is a small bundle of parallel muscular fibres, narrow posteriorly, expanded anteriorly, and holding in respect to the eyeball a position corresponding to its name. *Attached* posteriorly to the sphenoid bone round the margin of the optic foramen, they terminate anteriorly in four aponeurotic expansions, which are *attached* to the anterior aspect of the sclerotic, round the margin of the cornea. They respond externally to the fibrous sheath of the orbit, and by the rectus superior to the internal levator of the eyelid, internally they are related to the sclerotic and the adipose tissue connected with the cartilago-nictitans.

When these muscles contract in unison, the eyeball is drawn backwards, whereas by their individual action they turn the organ upwards, downwards, outwards, or inwards; again, the contraction of two at once will draw the eye in an oblique direction, so that from their

These repeat each other.

General form and structure.  
Situation.  
Origins.  
Insertion.

Relations.

Combined action.  
Separate actions.



individual or combined actions, the pupil may be turned to receive any rays of light that may fall upon the eye.

*Obliquus superior oculi*, (obliq. magnus oculi).—(Fig. 189, Nos. 1, 1.)—Situated in the supero-internal part of the orbit, the superior oblique is formed of a small cylindrical fleshy body, terminated anteriorly by an aponeurosis. It *arises* from above the border of the optie foramen, runs forwards along the internal wall of the orbit, and plays through a fibrous loop depending from the root of the orbital process; after this it turns outwards, becomes aponeurotic, passes under the superior rectus, and is *attached* to the sclerotic between that muscle and the external rectus. On its superior aspect is the pathetic nerve, on its inferior the supra-orbital branch of the ophthalmic.

**Action.** This muscle rotates the globe of the eye, turning its external aspect upwards, and its inferior outwards.

*Obliquus inferior oculi*, (obliq. parvus oculi).—Fig. 189, No. 6.)—Placed on the inferior aspect of the eye, this is shorter, but broader and thicker than the last muscle. It is almost entirely composed of fleshy fibres, which run from their *origin* in the lacrymal fossa, directly outwards to the infero-external aspect of the eye, to be *inserted* between those of the external and inferior recti.

**Action.** This muscle rotates the eye in an opposite direction to the last.

## MUSCLES OF THE FORE-LIMBS.

These may be conveniently considered in four great divisions, corresponding to the anatomical division of this part adopted in the **OSTEOLOGY**. These are: 1st, the *muscles of the shoulder*; 2nd, of the *arm*; 3rd, of the *fore-arm*; and 4th, of the *foot*.

### MUSCLES OF THE SHOULDER.

The proper muscles of the shoulder all take their origin upon the scapula, and their insertion upon the humerus, which they turn in the various directions permitted in that ray. They may be divided into two regions, an *external* and an *internal*.

### EXTERNAL SCAPULAR REGION.

**Contains four muscles.** This region is composed of four muscles, which cover the scapula externally, and which are covered in turn by a strong aponeurosis.

These are the *abductor*, *teres externus*, *antea spinatus*, and *postea spinatus*.

The aponeurosis covering this region is strong and thick superiorly, where it is attached to the cartilage of the scapula, and gradually diminishes in thickness in a downward direction, until it ends in areolar tissue on the external muscles of the arm. Covered externally by the panniculus, the trapezei, and the levator humeri, with the aponeurosis connecting the two latter, its internal surface is attached to the spine of the scapula, and sends fibrous prolongations into the interstices of the muscles, which it covers so as to enclose these in more or less perfect sheaths. It gives insertion to the anterior portion of the abductor, and the superior prolongation of the pectoralis prescapularis, by which it is accordingly rendered tense; from its anterior border, a thin fascia is continuous over the muscles of the internal scapular region.

Scapular aponeurosis strongest above.

Relations.

Sends folds between the muscles.

*Dissection.*—The aponeurosis having been studied, the limb may be separated from the trunk and the trapezei, the levator humeri, and the sterno-prescapularis removed from their scapular attachments. The aponeurosis may now be dissected off, leaving that part, however, which attaches the abductor to the spine of the scapula.

*Abductor brachii*, (scapulo-humeralis magnus, Gir.; scapular portion of the deltoid in man).—(Fig. 176, Nos. 10, 11; Fig. 185, Nos. 6, 7; Fig. 190, Nos. 1, 2.)—Situated on the outer and posterior aspects of the postea spinatus, the abductor is formed of an anterior and a posterior portion, separated by an interval, into which the aponeurosis of the levator humeri is received.

Position.

Two portions.

The anterior portion (Fig. 190, No. 1), which covers the postea spinatus, is of a deep red colour, thickly intermixed with tendon, and so far, at least, as its muscular portion is concerned, much the shorter of the two.

Anterior portion; its form and structure.

The posterior or larger portion (Fig. 190, No. 2), placed behind, and following the direction of the postea spinatus, is a bulky muscle in its median part, with gradually diminishing extremities, a flattened external, and a convex internal surface. It contains some tendinous fibres in its superior portion, though much less than the anterior part.

Posterior portion is the larger.

Is less tendinous.

The superior extremity of the anterior portion is received between two folds of the scapular aponeurosis; by which it is continued to the tubercle and superior part of the spine of the scapula; that of the posterior portion is attached to the posterior angle of the scapula.

Origin of the anterior portion;

and of the posterior.



Fig. 190.

## VIEW OF THE MUSCLES ON THE OUTER SIDE OF THE FORE-LIMB.

- |  |  |
|--|--|
| 1. Anterior portion of the abductor brachii.     | 11. Extensor pedis.                    |
| 2. Posterior portion of same.                    | 12. Ulnar attachment of the perforans. |
| 3. Antea spinatus.                               | 13. Flexor metacarpi externus.         |
| 4. Postea spinatus.                              | 14. Extensor suffraginis.              |
| 5. Scapula ulnaris.                              | 15. Extensor metacarpi obliquus.       |
| 6. Caput magnum of the triceps extensor brachii. |  |
| 7. Coraco-radialis.                              |  |
| 8. Portion of the levator humeri.                |  |
| 9. Caput medium of the triceps extensor brachii. |  |
| 10. Extensor metacarpi magnus.                   |  |



The two fleshy bodies unite inferiorly to be *inserted* on the external tuberosity of the body of the humerus, and the ridge leading down to it. Insertion.

This muscle responds externally to the aponeurosis with which its anterior part is continuous, and internally to the *teres externus* and *caput magnum* of the *triceps*. Relations.

Besides its action on the aponeurosis already mentioned, this muscle is an active abductor of the humerus, which it also rotates outwards and backwards. Acting with the *teres internus*, it will flex the shoulder-joint. Action.

*Differences.*—In *carnivora* this muscle is largely developed. Its anterior portion is attached to the lower end of the acromion process, and its posterior to the whole length of the spine of the scapula. Large in the dog.

*Dissection.*—By cutting across the abductor, and reflecting its parts upwards and downwards, the *teres externus* will be brought into view, partially covered by the *postea spinatus*.

*Teres externus*, (*scapulo-humeralis minor*, Gir.; *teres minor* in man).—(Fig. 192, No. 1.)—Extended along the posterior border of the scapula, this muscle is composed of an inferior muscular, and a superior tendinous portion. The first, forming the lower half of the muscle is prismatic, has various tendinous intersections, and is more or less separable into individual bundles. The tendinous portion is composed of several bundles, of which the posterior are the longer and thinner; it gives attachment on its outer aspect to some fibres of the *postea spinatus*. Position.  
Structure.  
  
Muscular portion.  
  
Tendinous portion.

It arises from the posterior border of the scapula, and is inserted on the capsular ligament of the shoulder-joint, on the external tubercle, on the head of the humerus, and on the ridge extending down from it. Origin.

Responding externally to the abductor and *postea spinatus*, it is related internally to the large and median heads of the *triceps extensor brachii*, and to the capsular membrane of the shoulder-joint. Relations.

This muscle acts with the preceding in abducting and rotating the humerus. Action.

*Antea spinatus*, (*super-acromio-trochiterius*, Gir.; *supra-spinatus* in man).—(Fig. 190, No. 3.)—Filling the whole fossa antea spinati, and bulging slightly in front of the scapula, this muscle is thick and prismatic, especially in its lower half, and bifurcated at its lower extremity. Its belly is almost entirely fleshy; its inferior divisions are partially tendinous, and connected by an aponeurosis. Situation.  
Form and structure.

It is attached superiorly on the whole fossa antea spinati, the

Insertion.	anterior border, anterior aspect of the spine, and part of the cartilage of the scapula; inferiorly, by its internal division to the inner, and by its external, to the outer tubercle on the head of the humerus.
Relations.	The antea spinatus responds externally to the scapular aponeurosis, internally to the bone and subscapularis, posteriorly to the spine and postea spinatus, and anteriorly to the sterno-prescapularis. The two divisions of the lower extremity, with a strong aponeurosis extending between them, embrace the tendon of the coraco-radialis, and are closely adherent to the capsular ligament of the elbow-joint.
Action.	This muscle is an extensor of the humerus, and of the aponeurosis covering the coraco-radialis. It also strengthens the scapulo-humeral articulation, to which it supplies the place of ligaments.
Is not bifid in the dog. Fig.	<i>Differences.</i> —In <i>carnivora</i> the antea spinatus is attached inferiorly by a single branch on the external tubercle. In the <i>pig</i> the few fibres to the internal tubercle are confounded with the pectoralis magnus.
Situation and form.	<i>Postea spinatus</i> , (sub-acromio-trochiterius, Gir.; infra-spinatus in man.)—(Fig. 190, No. 4.)—Situated in the fossa postea spinati, which it completely fills, the postea spinatus is broad and flattened in its superior part, prismatic in its middle, and conical inferiorly, where it terminates by two prolongations. The muscular, which are thickly interspersed with aponeurotic fibres, run forwards and downwards in the direction of the muscle. Of its inferior branches, the external is a true tendon, and the internal a semi-muscular, semi-aponeurotic band.
Structure.	It is <i>attached</i> superiorly by its muscular fibres and tendinous intersections on the fossa postea spinati, the cartilage, and posterior aspect of the spine of the scapula, as well as to the scapular aponeurosis. Of its inferior divisions, the internal is <i>inserted</i> on the inner aspect of the external tubercle, while the external plays over this tubercle, where it is supplied with a synovial bursa, and is <i>inserted</i> on the ridge leading to the external tuberosity of the humerus.
Origin.	This muscle is covered by the scapular fascia, and the abductor, and covers in turn the scapula, its cartilage, the attachment of the caput magnum of the triceps, and part of the teres externus, on the superior aponeurotic portion of which some of its fibres are inserted. Its lower extremity likewise covers the capsular ligament of the shoulder-joint. It responds anteriorly to the spine of the scapula, and the antea-spinatus muscle, and posteriorly to the abductor brachii.
Insertions.	The postea spinatus acts with the abductors and teres externus
Relations.	
Action.	

in abducting and rotating the humerus. It moreover sustains the functions of an external ligament of the shoulder-joint, and prevents outward displacement of the head of the humerus.

*Differences.*—In *carnivora* this muscle is attached inferiorly by a dog-tendinous branch only. The internal is wanting.

#### INTERNAL SCAPULAR REGION.

This region contains three muscles, the *subscapularis*, the *teres internus*, and the *scapulo-humeralis gracilis*. The two first are covered by a thin aponeurosis, continuous in front with that on the muscles outside the shoulder. Like the latter, the fascia diminishes in thickness from above downwards.

Contains three muscles.

Aponeurosis.

*Dissection.*—Having previously detached the limb from the body, place it with its internal aspect superiorly, and dissect off the internal scapular aponeurosis. Carefully preserve the attachments of the latissimus dorsi and the pectoralis magnus, that their relations to the muscles of the limb may be studied.

*Subscapularis*, (subscapulo-trochineus, Gir.)—(Fig. 191, No. 1.)—

This is a broad, flattened, and somewhat triangular muscle, occupying the whole fossa on the internal aspect of the scapula. Prolonged superiorly into three portions, and slightly converging towards its inferior extremity, where it ends in a tendon, it is composed of muscular, with a large admixture of tendinous fibres.

Form and situation.

Structure.

It arises from the whole subscapular fossa, and is inserted by strong tendon on the outer aspect of the internal tubercle on the head of the humerus, after playing over the superior part of that prominence, where its movements are facilitated by a synovial bursa.

Origin and insertion.

It responds internally, through the internal scapular aponeurosis and a thick layer of connective tissue, to the serratus magnus, also to the tendon of the coraco-humeralis, which glides over its tendon by the aid of a synovial bursa; externally it is related to the scapula and capsular ligament of the shoulder-joint, to which it is intimately connected. Its anterior border is intimately adherent in its superior two-thirds to the antea-spinatus, but in its inferior third is separated by an interval, through which pass the vessels and nerves to the dorsum scapulæ. Its posterior border is similarly related to the *teres internus*, but in its lower third is separated from it by an interval which lodges the subscapular vessels and nerves.

Relations.

This muscle acts as an antagonist to those on the external aspect of the scapula, adducting the humerus and rotating it slightly in-

Action.





Fig. 191.

## DRAWING OF THE MUSCLES ON THE INNER SIDE OF THE FORE-LIMB.

- |  |  |  |
|--|--|--|
| 1. Subscapularis.                                | 5. Coraco-humeralis.                             | 10. Fibrous band, passing from the coraco-radialis to the extensor metacarpi magnus. |
| 2. Teres internus.                               | 6. Attachment of the pectoralis magnus.          | 11. Extensor metacarpi magnus.   |
| 3. Aponeurosis of latissimus dorsi.              | 7. Coraco-radialis.                              | 12. Flexor metacarpi medius.   |
| 4. Caput magnum of the triceps extensor brachii. | 8. Caput parvum of the triceps extensor brachii. | 13. Flexor metacarpi internus.   |
| 4'. Scapulo-ulnaris.                             | 9. Radial insertion of the humeralis externus.   |  |

wards. It also supplies the part of a ligament to the shoulder-joint.

*Differences.*—In *ruminants* this muscle has a deep notch in its superior border for the reception of the serratus magnus. It is well developed in the *pig*.

Pig.

*Teres internus*, (adductor brachii, Ch.; subscapulo-humeralis, Gir.; teres major in man).—(Fig. 191, No. 2.)—Placed behind the subscapularis, in a direction from above downwards and forwards, the teres internus is an elongated muscle, flattened from within outwards, bulky in its median part, diminished towards its extremities, and terminated inferiorly by a tendon common also to the latissimus dorsi. Thick anteriorly, and becoming gradually thinner to its posterior border, the body is muscular, with some tendinous fibres on its outer aspect, and in its superior extremity.

Situation,  
direction,  
and form.

Structure.

It *originates* from the posterior angle of the scapula and the posterior border of the subscapularis, and is *inserted*, along with the latissimus dorsi, to the internal tuberosity of the humerus, between the two heads of the coraco-humeralis.

Origin.

Insertion.

The teres internus is related externally to the aponeuroses of the latissimus dorsi and scapulo-ulnaris, internally to the serratus magnus, from which it is separated by a thick layer of connective tissue. Its lower extremity responds externally to the caput medium and caput parvum of the triceps, and internally to the lower head of the coraco-humeralis, with several vascular and nervous twigs.

Relations.

It acts with the subscapularis in drawing the humerus inwards, and rotating it slightly. When acting at the same time with the abductor, it flexes the shoulder-joint.

Action.

*Scapulo-humeralis gracilis*.—Situated on the postero-internal aspect of the shoulder-joint, between the capsular ligament and the caput magnum of the triceps, this is a delicate bundle of bright red muscular fibres, *attached* on the margin of the glenoid cavity and the head of the humerus immediately beneath. The muscle seems peculiar to solipedes. Rigot, who first described it, thinks it prevents pinching of the capsular ligament during extreme flexion of the shoulder-joint.

Situation.

Structure  
and attach-  
ments.

#### ANTERIOR HUMERAL REGION.

This region contains three muscles, the *coraco-humeralis*, *coraco-radialis*, and *humeralis externus*.

Has three  
muscles.

*Coraco-humeralis*, (coraco-brachialis).—(Fig. 191, No. 5.)—Situated on the inner aspect of the humerus and shoulder-joint, this is an

Situation,  
form, and  
structure.

elongated muscle, composed of two fleshy bellies, more or less completely divided inferiorly, but terminating superiorly by a common tendon. The deep belly is almost entirely formed of muscular tissues, while the superficial is intermixed with tendinous fibres.

**Origin.** The common tendon is *attached* superiorly on the inner aspect of the coracoid process, from which it runs over the subscapularis tendon and ends in the two fleshy bellies. Of these the superior is *inserted* above and the inferior below the internal tuberosity of the body of the humerus; between them, the common tendon of the latissimus dorsi and teres internus is inserted. A few muscular fibres joining the two bellies are frequently attached to the bone, behind the insertion of the latter.

**Relations.** This muscle is covered by the coraco-radialis and pectoralis parvus, the latter being also partly inserted to its tendon. It responds internally to the latissimus dorsi, teres internus, humeralis externus, caput medium of the triceps, and, by its tendon, to the subscapularis tendon, over which it glides by the aid of a synovial bursa. Its posterior border is in contact with vascular and nervous trunks, and between its two bellies pass the anterior humeral nerve, a small arterial and a venous twig.

**Action.** It adducts the humerus, and rotates it slightly inwards.

**In dog and pig is undivided inferiorly.** *Differences.*—In *carnivora*, this muscle has a single belly, attached to the humerus behind the tendon of the teres internus; its insertion extends both higher and lower than the latter, but does not embrace it as in the horse. In the *pig* it is also undivided, very tendinous, and attached on the anterior aspect of the humerus.

*Dissection.*—To expose the coraco-radialis, place the limb on its internal aspect, turn back the humeral insertions of the levator humeri, sterno-aponeuroticus, and pectoralis parvus, over the triceps extensor, and split up the lower end of the antea spinatus to show its superior tendon. Its lower extremity, being covered by the internal lateral ligament of the elbow, and the humeralis externus, can only be perfectly studied after the removal of the latter.

*Coraco-radialis*, (flexor brachii, Per.; biceps brachialis in man).—(Fig. 191, No. 7; Fig. 192, No. 3.)—This muscle is placed in front of the humerus, in a direction from above downwards and backwards. It is long and cylindric, of considerable thickness in its median part, and bifid inferiorly. Its muscular belly is intersected by various folds of aponeurosis, of which, one towards the centre is very thick, and traverses the muscle throughout, becoming continuous with its terminal tendons.

**Position and direction.** The coraco-radialis arises from the lower aspect of the coracoid

**Form.**

**Structure.**

**Origin.**



process by a strong rounded tendon, having some muscular fibres on its anterior aspect; this tendon assumes a fibro-cartilaginous structure in front of the bicipital groove, and a form adapted to its playing its tendon plays over bicipital groove.



Fig. 192.

## MUSCLES SURROUNDING THE HUMERUS—DEEP LAYER.

- |                        |                     |
|------------------------|---------------------|
| 1. Teres externus.     | 3. Coraco-radialis. |
| 2. Humeralis externus. | 4. Anconeus.        |

over the latter, to terminate immediately beneath in the muscular body. The principal tendon of the lower extremity, which is short and powerful, is inserted on the bicipital tuberosity and capsular Insertion. gament of the elbow-joint, insinuating itself beneath the internal

**Aponeurosis to the extensor metacarpi.** lateral ligament of that articulation. The second inferior division is a strong, flattened, fibrous band (Fig. 191, No. 10), given off at the junction of the tendinous and fleshy portions, and going to the extensor metacarpi magnus and fascia of the fore-arm.

**Relations.** This muscle is covered by the antea spinatus, between the two divisions of which it passes, and by an aponeurosis continuous with the latter muscle, by which it is separated from the humeralis externus, the levator humeri, and the sterno-aponeuroticus. Its posterior aspect is covered by a layer of adipose tissue, by which it is separated from the capsular ligaments of the shoulder and elbow joints, from the anterior aspect of the humerus and the humeralis externus.

**Action.** The coraco-radialis is a flexor of the fore-arm, and an extensor of the aponeurosis covering the same. The flattened tendon that runs throughout the whole length of the muscle, and extends to the fascia of the fore-arm, seems chiefly intended to act mechanically in promoting the flexing of the shoulder-joint while the animal is standing, the elbow being, meanwhile, extended by the powerful extensors of the fore-arm.

**Ox.** *Differences.*—In *ruminants* the chief difference is the smaller bulk and the more tendinous structure. The superior tendon is not moulded in the same manner, as the bicipital groove is single. In the *pig* and *dog* the same remarks apply. In these two its inferior attachments are peculiar; thus, one tendon goes to the bicipital tuberosity, while a second glides over the inner aspect of the radius, where it is supplied with a synovial bursa, and is inserted inside the ulna, at the base of the olecranon.

Lower insertion in dog and pig is on both the radius and ulna.

*Dissection.*—Lay the limb on its internal aspect; remove the abductor, teres externus, and postea spinatus, together with the caput magnum and caput parvum of the triceps, so as to expose the superior extremity of the humeralis externus; next, by turning the member on its external aspect, the lower end will be exposed.

*Humeralis externus*, (humero-radialis, Gir.; brachialis anterior in man).—(Fig. 191, No. 9; Fig. 192, No. 2).—Lodged in, and filling up, the musculo-spiral groove, the direction of which it follows, this muscle is placed successively, from above downwards, on the posterior, external, and anterior aspects of the humerus, also on the front of the elbow-joint, and on the internal aspect of the radius. Large and thick in its superior part, it is somewhat diminished inferiorly. It is almost entirely fleshy.

**Origin.** It originates by very short tendinous fibres from the posterior

aspect of the humerus, immediately beneath its articular head, and terminates inferiorly in a flattened tendon, which, passing beneath the internal lateral ligament, is *inserted* by one division on the internal aspect of the radius, and by a second on the archiform fibres, by which it is continued to the ulna. Insertion.

Responding internally to those parts already mentioned, it is related internally to the *teres internus* and *caput medium* of the *triceps*; posteriorly and externally to the other two heads of the *triceps* and the *aponeurosis*, uniting the *extensor metacarpi magnus* to the external tuberosity of the body. The lower extremity is covered by the latter muscle, the inferior fibrous prolongation of the *coraco-radialis*, and the internal lateral ligament of the elbow. Relations.

This muscle is simply a flexor of the fore-arm. Action.

*Differences.*—In the *pig*, *dog*, and *cat*, its inferior tendon plays through a synovial sheath on the internal aspect of the radius, to be inserted on the ulna along with the *coraco-radialis*. In pig and carnivora is inserted on the ulna.

#### POSTERIOR HUMERAL REGION.

This region is composed of five muscles, all of which are inserted on the olecranon. These are the *scapulo-ulnaris*, the *three heads* of the *triceps extensor brachii*, and the *anconeus*. Contains five muscles.

*Dissection.*—As the muscles of this region have to be removed in order to expose the *humeralis externus*, they ought to be dissected at the same time. By laying the member on its internal aspect, and dissecting the *aponeurosis* from the external surface of this region, the *caput magnum* and *caput medium* will be exposed; next, by carefully cutting through the latter of these muscles, and removing it from its intimate connection with the *anconeus*, that muscle may be examined. The limb may now be placed on its external aspect, and the *scapulo-ulnaris* observed, its *fascia* should be carefully separated from its intimate relations with the *caput magnum*; afterwards the *caput parvum* may be exposed by dissecting off the vessels, nerves, and lymphatic glands by which it is covered.

*Scapulo-ulnaris*, (*scapulo-olecranius longus*, Gir.—(Fig. 191, No. 4'.)—Placed in the scapulo-humeral angle, on the inner aspect and posterior border of the *caput magnum* of the *triceps*, this is a broad flattened muscle, consisting of a superior aponeurotic and an inferior muscular portion. The latter gradually increases in thickness from above downwards, and is easily divisible into two bundles, an anterior, forming the bulk of the muscle, and a posterior, flat and thin, terminating on the olecranon by a separate tendon. Its fibres run in a vertical direction. Situation, form, and structure.

*Originating* from the whole posterior border of the scapula, it is Origin.



- Insertion.** *inserted* on the posterior border of the olecranon and the aponeurosis inside the fore-arm.
- Relations.** It is related externally to the caput magnum and caput parvum, to the former of which its fascia is intimately connected; internally, to the latissimus dorsi, teres internus, and pectoralis magnus. Its antero-inferior border is continuous inside the limb with the aponeurotic sheath covering the coraco-radialis.
- Action.** This muscle extends the radius, and renders tense the aponeurosis of the fore-arm.
- Superior attachment in dog and pig.** *Differences.*—In *carnivora* and in the *pig* the scapulo-ulnaris takes its origin by aponeurosis from the external surface of the latissimus dorsi. It is constant in the domestic animals.
- The *triceps extensor brachii*, (triceps cubiti in man), though a single three-headed muscle in the human subject, is almost entirely divided in the lower animals into three separate muscles—the *large, median, and small heads*.
- A.—Caput magnum**, (scapulo-olecranius major, Gir.; middle head of the triceps in man).—(Fig. 176, No. 15; Fig. 185, No. 8; Fig. 190, No. 6; Fig. 191, No. 4).—Placed between the teres internus and externus, this is an enormous triangular muscle, filling up the whole scapulo-humeral angle. It is composed of large muscular fasciculi, with some aponeurotic intersections, and two layers of fascia on the lateral aspects of its anterior border. Its fibres converge to its postero-inferior angle.
- Position and form.**
- Structure.**
- Origin.** It *arises* either by its substance directly, or by the layers of aponeurosis already mentioned, upon the posterior border and angle of the scapula, and is *inserted* by strong tendon on the posterior part of the summit of the olecranon. This tendon receives some fibres of the caput medium, and plays over the anterior part of the olecranon, where it is provided with a synovial bursa.
- Insertion.**
- Relations.** Related externally through a fold of white fibrous and yellow elastic tissue, to the panniculus, teres externus, and abductor, for the latter of which it bears a depression near its anterior border, it responds internally to the scapulo-ulnaris, and through its aponeurosis, to the latissimus dorsi and teres internus. Its posterior border is covered by the scapulo-ulnaris; its inferior is in contact with the two other heads of the triceps.
- Action.** The caput magnum powerfully extends the fore-arm.
- Os.** *Differences.*—In *ruminants* the insertion on the fascia of the fore-arm is more extensive.

*Caput parvum*, (humero-olecranius internus, Gir.)—(Fig. 191, No. 8.)—Situated on the posterior internal aspect of the humerus, in a direction from above backwards and downwards, this is a short muscle, somewhat pyramidal in form, with its base supero-anteriorly, and its apex postero-inferiorly, the latter terminating in two flat tendons. Situation and form.

It *originates* from the shaft of the humerus, above and behind the insertion of the teres internus; it is *inserted* by one tendon on the summit of the olecranon, and by the other, which plays over the internal aspect of that process, on its posterior border, and on the brachial fascia. Origin. Insertion.

It responds superiorly to the caput magnum, externally to the caput medium, the humeralis externus, and the body of the humerus, internally to the common tendon of the teres internus and latissimus dorsi, the lower head of the coraco-humeralis, the vessels and nerves on the internal aspect of the bone, and the insertion of the scapulo-ulnaris on the brachial fascia. Relations.

It assists in extending the fore-arm. Action.

*Differences*.—In the *carnivora* and *pig* this muscle is long and bulky. Dog and pig.

*Caput medium* (humero-olecranius externus, Gir.)—(Fig. 176, No. 14; Fig. 190, No. 9.)—Placed on the postero-external aspect of the humerus, in a direction from above downwards and backwards, this is a short bulky muscle, flattened and aponeurotic superiorly, but prismatic inferiorly, where it becomes entirely muscular. Its fibres run parallel to the direction of the muscle. Position, form, and structure.

It *arises* by its aponeurosis from the curved line extending from the external tuberosity of the body to the articular head of the humerus. Inferiorly it is *attached* to the summit of the olecranon, in part directly, and in part through the medium of the tendon of the caput magnum. Origin Insertion

The caput medium is intimately related superiorly to the caput magnum; its external surface is in contact with the abductor, teres externus, and an aponeurosis extending between that on the inner aspect of the caput magnum and that on the inner aspect of the fore-arm; its internal surface responds to the caput parvum, humeralis externus, extensor metacarpi magnus, and anconeus, with the last of which it is partly blended. Like the other heads of the triceps, this is an extensor of the fore-arm. Relations Action

*Differences*.—In *ruminants* this muscle originates partly from the capsular ligament of the shoulder-joint.

Situation, form, and relations.	<i>Anconeus</i> , (humero-olecranius minor, Gir.)—Placed above and behind the capsular ligament of the elbow, this is a short but thick and prismatic muscle, intimately adherent above to the caput parvum, and below to the synovial <i>cul-de-sac</i> occupying the olecranian fossa.
Origin.	It <i>arises</i> from the margin of the above-named fossa, especially from its superior and external parts, and is <i>inserted</i> on the anterior border and external aspect of the olecranon. This muscle acts with the triceps in extending the limbs, and also raises the synovial membrane of the elbow.
Insertion.	
Action.	
Des.	<i>Difference</i> .—It is relatively very large in <i>carnivora</i> .

## MUSCLES OF THE FORE-ARM.

Nine  
muscles in  
this region.

Nine muscles are found situated around the fore-arm, the bones of which they envelope on all sides, with the exception of the internal. Each of these is terminated by a single or bifid tendon, and all take their insertion on some part of the foot—carpus, metacarpus, or phalanges, of which, accordingly, they are either flexors or extensors.

Brachial  
fascia.

The whole segment is enclosed in a thick and powerful aponeurosis, which firmly embraces the muscles, and is attached to the posterior border of the olecranon, the internal surface of the radius, and the lower end of that bone on both its inner and outer aspects. It is continuous superiorly, though in a much less bulky form, on the muscles of the humeral region, with the coraco-radialis through its anterior aponeurosis, with the scapulo-ulnarius, and with the pectoralis transversus, the fascia of which unites with it at some distance down the limb, so that it is composed of two folds in its superior part internally. Inferiorly it is continuous over the carpus, and becoming greatly thickened, forms a powerful sheath for the joint. The external aspect of this aponeurosis is covered by numerous vascular and nervous twigs; its internal surface responds to the muscles, to several of which it is intimately adherent, and between which it sends aponeurotic prolongations by which they are mostly embraced. The fascia is rendered tense by the contraction of the three muscles, the insertions of which it receives, especially the coraco-radialis and scapulo-ulnaris. The pectoralis transversus is so low in taking its insertion, that it affects the fascia comparatively little.

Its relations.

*Dissection*.—The simple removal of the skin and brachial fascia from the limb, is nearly all that is necessary to observe all the muscles of the fore-arm. Those taking insertion within the hoof, however, call for the removal of that organ in order to their study. This may be effected by macerating it, and pulling it off



with a pair of strong pincers, or more rapidly by placing the horn for a few minutes over a good charcoal fire, and applying the pincers in the same manner. By either of these methods the dissection is liable to be injured. This may be avoided by the following method:—Cut the horn from the cuta-dura with a sharp scalpel, do the same by the fibrous and horny frog, then with a strong knife and hammer cut the wall of the hoof from above downwards, throughout its whole extent, at four or five places; next, with a strong pair of pincers, detach the strips of horn thus formed, after which the sole may be pulled off in one piece by the same instrument.

#### ANTERIOR BRACHIAL REGION.

This region contains four muscles, the *extensor metacarpi magnus*, *extensor metacarpi obliquus*, *extensor pedis*, and *extensor suffraginis*. Has four muscles. These are placed on the antero-external aspect of the limb, and cover about two-thirds the circumference of the radius.

*Extensor metacarpi magnus*, (epitrochlo-premetacarpeus, Gir.; extensor metacarpi antierius, Ch.; extensores carpi radialis in man).—(Fig. 176, No. 17; Fig. 190, No. 10; Fig. 191, No. 11.)—Situated in the median line, on the anterior aspect of the radius, this muscle is in the form of an elongated cone, with its apex inferiorly, and terminated below the middle third of the radius, in a rounded tendon, which becomes flattened previous to taking its lower insertion. The fleshy portion is formed of muscular fibres, intersected by several layers of aponeurosis, one of which is received from the coraco-radialis. The fibres are perpendicular, except at the superior extremity of the muscle, where they arch forwards over the elbow-joint. Situation. Form. Structure. Fibrous band from the coraco-radialis.

The muscular portion is attached superiorly to the epitrochlean crest; to the anterior aspect of the humerus, immediately above the articular surface of the trochlea, and the external lateral ligament of the elbow, by a strong fibrous band, common also to the extensor pedis; lastly, to the external tuberosity of the body of the humerus, by an aponeurosis, which envelopes the superior extremity of the muscle. Its tendon is attached in front of the upper extremity of the large metacarpal bone, after gliding through a synovial sheath, on the lower extremity of the radius and anterior common ligament of the carpus. Origin. Insertion.

Covered by the humeralis externus and fascia of the fore-arm, and the tendon of the oblique extensor, the extensor metacarpi magnus covers in turn the anterior aspect of the radius and elbow-joint, responds externally to the extensor pedis, and internally by its upper extremity to the humeralis externus. Its tendon is enclosed in the sheath already mentioned. Relations.

- Action.** This muscle is a direct extensor of the metacarpus.
- Pig.** *Differences.*—In the *pig* the tendon of this muscle takes its insertion on the innermost of the two large metacarpal bones.
- Dog and cat.** In *carnivora* it bifurcates, and, like as in man, is inserted on the metacarpals of the second and third digits; the strongest tendon goes to the latter.
- Situation, direction, and structure.** *Extensor metacarpi obliquus*, (radio-premetacarpeus, Gir.; extensor ossis metacarpi pollicis et extensor primi internodii pollicis in man). (Fig. 190, No. 15.)—Placed on the anterior aspect of the radius, in its lower third, this muscle is formed of a muscular part, placed on the antero-external aspect of the radius, and a tendon which runs beneath that of the extensor pedis, above that of the extensor metacarpi magnus, and through a synovial sheath, to gain the internal aspect of the carpus. The muscular portion is penniform, and contains much tendinous structure.
- Origin.** It *arises* on the external aspect of the radius, and is *inserted* on the head of the internal metacarpal bone. Covered by the extensor pedis and the brachial fascia, this muscle responds internally to the radius, the tendon of the extensor metacarpi magnus, the anterior, common, and the external lateral ligaments of the carpus. It runs over the last two, enveloped in its fibrous sheath.
- Insertion.**
- Relations.**
- Action.** It extends the metacarpus, turning it forwards and inwards.
- Ox.** *Differences.*—In the *ox* its tendon goes to the inner aspect of the head of the large metacarpal bone. In the *pig* it originates from both radius and ulna, and is inserted on the internal small metacarpal bone. In *carnivora* it has a similar origin to that of the *pig*, and is inserted on the scaphoid, the internal lateral ligament, and the metacarpal of the first digit; it adducts and extends the first digit.
- Dog and cat.**
- Situation.** *Extensor pedis*, (epitrochlo-prephalangeus, Gir.; extensor communis digitorum in man).—(Fig. 176, No. 16; Fig. 190, No. 11.)—Situated on the antero-external aspect of the radius, outside the extensor metacarpi magnus, the extensor pedis is composed, like the latter, of a muscular and a tendinous portion. The muscular portion, large and fusiform, is flattened superiorly, bifid anteriorly, and intersected by numerous tendinous layers. The tendinous portion, which succeeds the muscular, between the middle and lower thirds of the radius, is composed of a large and a smaller tendon, which run down the anterior aspect of the radius in company, and play over the anterior common carpal ligament, where they are supplied with a synovial
- Muscular belly; its form and structure. Tendon; its course.**

sheath, and to which they are bound by an annular ligament; emerging from this, the smaller tendon separates from the external aspect of the other, and receiving a tendinous slip from the extensor suffraginis, about the middle of the cannon, turns in to rejoin the larger, close to the fetlock-joint, the resulting tendon, passing over the fetlock, adheres to its capsular ligament, spreads out on the anterior aspect of the digital region, receives a tendon on each side from the inferior suspensory ligament, and ultimately gains the pyramidal process of the os pedis.

Its connection with the extensor suffraginis,

the fetlock-joint,

and suspensory ligament.

It *arises* from the epitrochlean crest, the front of the lower extremity of the humerus, the external lateral ligament of the elbow, the external tuberosity of the head of the radius, and the external aspect of the same bone. Its tendon is *inserted* inferiorly on the capsular ligament of the fetlock, the lower end of the os suffraginis, the anterior aspect of the os coronæ, and the pyramidal process of the os pedis.

Origin.

Insertion.

The muscular portion responds externally to the brachial fascia, internally to the elbow-joint, radius, and extensor metacarpi obliquus, anteriorly to the extensor metacarpi magnus, to which its superior half is intimately adherent, and posteriorly to the extensor suffraginis. The relations of its tendinous part may be studied above; it need only be added that, from its flattened form, it is capable of supplying the part of capsular ligaments in the interphalangean articulations, and that in front of the fetlock it has a small synovial bursa on its internal aspect.

Relations.

From its insertions on the three phalanges, this muscle extends each individually upon the bone above it, and at the same time extends the metacarpus on the fore-arm.

Action.

*Differences.*—In *ruminants* this muscle is divided throughout its whole length into two parallel portions, an external, common to both digits, and an internal, which extends one digit only. The *common extensor*, the larger, becomes tendinous in the lower third of the radius, and the tendon, running over the anterior aspect of the carpus and metacarpus, bifurcates at the division of the digits, and sends a tendon to the pyramidal process of each ungual phalanx. This muscle extends and separates the digits. The *extensor of the internal digit* resembles the common extensor in form and direction. Its tendon passes with that of the latter through a common synovial sheath in front of the carpus, and only leaves it on a level with the metacarpo-phalangean articulation; here it turns towards the inter-

Is double in ruminants.

Common extensor.

Extensor of the inner digit.



nal aspect of the limb, expanding considerably, receives a tendon on each side of the phalanx from the suspensory ligament of the fetlock, and terminates inferiorly by two tendons. One of these goes to the anterior aspect of the second phalanx; the other, much the broader of the two, covers the common external lateral ligament of the interphalangean joints, and is inserted on the whole internal aspect of the distal phalanx. In the *sheep* this latter branch is small, and directs itself towards the heel, where it is confounded with the plantar cushion.

In the pig  
is likewise  
double.

In the *pig* this muscle is represented by two similarly arranged to those in the ox. The *common extensor* divides inferiorly into four bundles, which take their insertions on the distal phalanges of the respective digits; that going to the small external digit often gives off a small bundle, which, bifurcating, joins those going to the two anterior digits. The *extensor of the internal digits* has a bifid tendon, the divisions of which are inserted on the distal phalanges of the two internal digits, on that aspect corresponding to the internal side of the limb.

Single in the  
dog and cat.

The *carnivora*, like the solipedes, have only one *common extensor of the phalanges*, which, dividing into four tendons inferiorly, is thus inserted on the pyramidal processes of the distal phalanges of the four principal digits.

Situation.

Form.

Structure

Tendon; its  
course.

Fibrous  
band from  
the pisiform.

Origin.

*Extensor suffraginis*, (radio-prephalangeus, Gir.; extensor phalangei lateralis, Ch.; extensor minimi digiti in man).—Fig. 190, No. 14.)—Situating vertically on the outer side of the fore-arm, between the extensor pedis and the flexor metacarpi externus, this muscle is composed of a muscular and a tendinous portion. The muscular part is small, flattened from before backwards, enclosed in a special aponeurotic sheath, and ends in the tendon in the lower fourth of the fore-arm. It is semipenniform, with the fibres running downwards and forwards. The tendon, at first round, but afterwards flattened, occupies the groove in the external tuberosity of the lower end of the radius, and passing through a synovial sheath outside the carpus, crosses the external lateral ligament; on joining the anterior aspect of the metacarpus, it sends a slip to the small tendon of the extensor pedis, and receives a strong aponeurotic band from the external aspect of the pisiform; descending outside the tendon of the extensor pedis, it expands in passing over the fetlock-joint to gain the superior extremity of the first phalanx.

It *originates* from the external lateral ligament of the elbow, the

external tuberosity on the head of the radius, the outer aspect of this bone and of the ulna. Inferiorly it is *inserted* on the capsular ligament of the fetlock-joint, and the front of the upper extremity of the os suffraginis. Insertion.

This muscle responds externally to the aponeurosis covering it, and in its tendinous portion to the carpal theca, through which it passes, and to the skin; anteriorly it is related to the extensor pedis, posteriorly to the flexor metacarpi externus; internally to the external lateral ligament of the elbow, the outer aspects of the radius and ulna, the external lateral ligament of the carpus, with the anterior aspect of the cannon and metacarpo-phalangean joint. Relations.

This muscle extends the first phalanx, and, less directly, the foot. Action.

*Differences.*—In *ruminants* this is a large muscle, having its superior attachment similar to that of the horse, but holding inferiorly, in relation to the outer digit, a position exactly similar to that of the extensor of the internal digit to that division. It is, consequently, an *extensor of the outer digit*, and, like its homotype, internally tends to separate the claws. Ruminants.

In the *pig* its tendon expands on the outer aspect of the external small digit. Pig.

In *carnivora*, the lower tendon of this muscle divides into three, which go to the three external digits, becoming confounded with those of the common extensor or the muscular slips which the interosseous metacarpals send to the latter. Dog and cat.

#### POSTERIOR BRACHIAL REGION.

Five muscles occupy the posterior aspect of the fore-arm; three of these, the *external*, *median*, and *internal flexors* of the *metacarpus*, lie superficially, while two, the *flexors of the foot* (*perforans* and *perforatus*), are covered by the former. Contains five muscles.

*Flexor metacarpi externus*, (epitrochlo-supercarpens, Gir.)—(Fig. 176, No. 18; Fig. 190, No. 13.)—Situated on the postero-external aspect of the fore-arm, between the extensor suffraginis and the flexor metacarpi medius, this is an elongated muscle, flattened from before backwards, bulging at its median part, concave internally, convex externally, and containing much tendinous structure. Situation, form, and structure.

It *arises* superiorly by a very short powerful tendon, behind, and partially united to the extensor suffraginis from the superior part of the epitrochlea, and terminates inferiorly in a longer tendon, which Origin.

bifurcates into an anterior and a posterior. The former is a rounded Insertions—  
anterior and  
posterior.

cord which runs through the groove outside the pisiform bone, where it is supplied with a synovial membrane, and bound down by a fibrous sheath, to be *inserted* on the head of the outer small metacarpal bone along with the external lateral ligament of the carpus; the latter is a short flattened tendon, *inserted* along with the median flexor on the pisiform bone.

**Relations.** Placed between the median flexor and the extensor suffraginis, this muscle is covered by the brachial fascia, and covers, in turn, the capsular ligament of the elbow, the flexor muscles of the foot, and the pisiform bones. Its superior tendon is behind the lateral ligament of the elbow, its inferior behind that of the carpus.

**Action.** This is a true flexor of the metacarpus.

**Pig and carnivora.** *Differences.*—In the *pig*, *dog*, and *cat*, the anterior branch of the inferior tendon goes to the head of the outer metacarpal bone.

*Flexor metacarpi medius*, (epicondylo-supercarpeus, Gir.; flexor metacarpi obliquus, Bourg.)—(Fig. 191, No. 12.)—Occupying the median posterior part of the fore-arm, this muscle closely resembles the preceding in form, structure, and direction. It *arises* from the epicondyle by a strong tendon, and from the olecranon by a pale fleshy band, which unites with the ulnaris accessorius. Inferiorly it is *inserted* on the pisiform by a broad tendon uniting with that of the external flexor. Placed between the internal and external flexors of the metacarpus, the flexor metacarpi medius responds posteriorly to the brachial aponeurosis, to which its superior tendon and its ulnar portion are intimately connected, and anteriorly to the two flexors of the foot.

**Action.** The action of this muscle is similar to that of the last.

**Carnivora.** *Differences.*—In *carnivora* the perforatus lies over this muscle. Its ulnar division is large, and only joins the principal portion inferiorly.

*Flexor metacarpi internus*, (epicondylo-metacarpus, Gir.; palmaris longus in man).—(Fig. 176, No. 19; Fig. 191, No. 13.)—Placed vertically on the postero-internal aspect of the fore-arm, and resembling the other two flexors of the metacarpus in general outline, this muscle differs from these in being narrower, thicker, and possessed of fewer tendinous fibres. It *arises* from the epicondyle along with the muscle last described, with which it is here confounded; it terminates by a long delicate tendon, which, passing through a fibrous and synovial sheath on the inner aspect of the carpus, is *inserted* on the head of the internal metacarpal bone.



Covered by the fascia of the fore-arm, this muscle covers, in turn, Relations. the internal aspect of the elbow-joint, the radius, the posterior radial artery and vein, the ulnar nerve, and part of the flexor metacarpi medius and perforans.

It acts with the medius and externus in flexing the metacarpus. Action.

*Differences.*—In *ruminants* the inferior tendon of this muscle is Ruminants. inserted on the head of the large metacarpal bone. In the *pig* it goes Pig. to the metacarpal of the large internal digit. In the *dog* the fleshy Carnivora. body is small, and the delicate tendon is inserted on the metacarpal of the second digit.

*Flexor pedis perforatus*, (epicondylo-phalangeus, Gir.)—Situ- Situation. ated deeply on the posterior aspect of the fore-arm and foot, and covered in its fleshy part by the flexors of the metacarpus, this is a large and elongated muscle, composed of a fleshy and a tendinous portion. The muscular portion, extending from the lower end of the humerus, nearly Muscular portion. to the carpus, is thin, prismatic, and possessed of numerous tendinous intersections. The tendon continuous with the lower end of the last, Tendon; its course. receives a powerful fibrous band from the postero-inferior aspect of the radius, some of the fibres of which go to the brachial aponeurosis Radial ligament. and the perforans. Thus strengthened, it passes beneath the posterior annular ligament of the carpus, and the whole length of the metacarpus, in company with the perforans tendon, for the reception of which, its anterior aspect is somewhat concave. Immediately above the pastern-joint it forms a ring through which passes the tendon of the perforans, and passing over the pulley formed by the sesamoids, reaches the lower end of the os suffraginis, where it bifurcates, sending a tendon forward on each side of the perforans.

The perforatus *originates* from the epicondyle along with the per- Origin. forans, and is *inserted* at each extremity of the glenoid fibro-cartilage Insertion. and the os coronæ.

Covered by the flexor muscles of the metacarpus, the muscular Relations. portion is inseparably united to that of the perforans throughout the greater part of its extent. The tendon, lying behind that of the per- Fleshy belly inseparable from the perforans. forans, is covered by the posterior annular ligament of the carpus, and the same production of the sesamoids. For the description of the latter, see the *Region of the Foot*.

This muscle is a direct flexor of the second phalanx upon the Action. first, less directly of the first upon the metacarpus, and of the latter upon the fore-arm. By means of the radial ligament it also supports the fetlock-joint mechanically while the animal is standing.

*Ruminants.* *Differences.*—In *ruminants* the perforatus has two fleshy bellies, which unite in the middle of the metacarpal region. The resulting single tendon again bifurcates, sending a division to each digit, which comports itself exactly like that of the perforatus in the horse. The ligament from the origin of the suspensory, which, in solipedes, joins the perforans, goes in these animals to the perforatus.

Metacarpal  
ligament  
joins the  
perforatus.  
Fig.

In the *pig* a similar arrangement exists, the two lower tendons taking insertion on the second phalanges of the two large digits.

*Carnivora.*

In *carnivora* the long broad fleshy body is superficial to, and quite distinct from, the perforans. It takes its origin from the epicondyle and posterior border of the olecranon: its tendon passes outside the posterior annular ligament of the carpus, and divides into four tendons, which are inserted on the superior ends of the second phalanges of the four outer digits, after forming rings for the tendons of the perforans.

*Position.*

*Flexor pedis perforans*, (radio-phalangeus, Gir.)—Situated on the posterior aspect of the fore-arm in front of the perforatus, the *perforans* is a long muscle, continued by its terminal tendon down the posterior aspect of the carpus, metacarpus, and phalanges, as far as the inferior surface of the os pedis. Its muscular belly is prismatic, and three times as large as that of the perforatus, with which it is mostly confounded. It contains numerous tendinous fibres, especially towards its origin. The fibres, which are at first slightly bent over the posterior aspect of the elbow, afterwards run perpendicularly in the same direction as the muscle. It *arises*, by its superior extremity, from the epicondyle of the radius, and terminates immediately above the carpus by a rounded tendon upon which its fibres are inserted.

Form of  
muscular  
belly ;

its structure.

*Origin.*

*Tendon ;*

its course.

Metacarpal  
ligament.

The tendon, after receiving the tendons of the ulnaris accessorius and radialis accessorius, passes under the posterior annular ligament of the carpus, and down the posterior aspect of the metacarpus in front of the perforatus tendon. In the middle third of the metacarpus it receives the insertion of a strong fibrous cord (metacarpal ligament), which arises, along with the suspensory ligament, from behind the superior extremity of the large metacarpal bone. Immediately above the sesamoids it passes through the ring of the perforatus, then glides over the groove on the posterior aspect of the former, between the terminal branches of the perforatus, and over the glenoid cartilage of the os coronæ; beneath this it expands, plays over the

posterior aspect of the navicular bone, and is ultimately *inserted* on the whole semilunar crest of the os pedis. Insertion.

Covered posteriorly by the perforatus, the perforans responds anteriorly to the condyle of the humerus, the synovial membrane of the elbow-joint by means of a *cul-de-sac*, of which it plays over the superior extremity of the radius, to the radius and radialis accessorius. Its tendon, which is covered throughout the greater part of its extent by that of the perforatus, responds anteriorly to the posterior common carpal ligament, the suspensory ligament, the sesamoid bones, and their inferior ligaments. Its inferior expanded portion is covered by the posterior common digital ligament, and responds anteriorly to the coronet and navicular bones, together with a large synovial bursa which facilitates its gliding over the latter. This bursa covers the whole opposite gliding surfaces of the bone and tendon, and is prolonged into two *cul-des-sacs*, a superior and an inferior. The former extends upwards to the level of the sesamoidean bursa, from which it is separated by a band of yellow elastic tissue, which binds the perforans to the second phalanx; it lies in contact anteriorly with the synovial membrane of the second interphalangean articulation. The latter extends between the navicular and pedal bones, covering the lower surface of the interosseous ligament. Relations.

The perforans flexes the phalanges upon each other, those on the metacarpus and the latter on the fore-arm. By virtue of the metacarpal ligament which it receives, it affords a mechanical support to the fetlock-joint and digital region while the animal is standing. Action.

*Differences.*—In *ruminants*, as already mentioned, the metacarpal ligament goes to the perforatus, and not to the perforans tendon. The latter divides above the fetlock into two branches, an internal and an external, which, after traversing the rings formed by the tendons of the perforatus, go to their respective digits. Each terminates on the postero-inferior aspect of the distal phalanx, becoming confounded with the inferior interdigital ligament, the plantar cushion, and an aponeurosis which covers the posterior aspect of the metacarpus and digits. This aponeurosis covers the flexor tendons in the metacarpal region, descends upon the digital, and bifurcating, is inserted on the posterior and external aspects of each distal phalanx. In its course it is intimately attached to the posterior sesamoid, annular, and superior interdigital ligaments, while towards insertion it is confounded with the plantar cushion, the perforans tendon, and the inferior interdigital ligament. Ruminants.  
Tendon  
bifurcates.  
  
Plantar  
fascia.



- Pig.** In the *pig* the perforans tendon divides into four, which are inserted on the four distal phalanges.
- Dog and cat.** In *carnivora* the tendon divides into five branches, which are *inserted* on the inferior sesamoidean eminences of the distal phalanges. Above the knee it gives off a small tendon to the posterior annular ligament of the carpus.
- Ulnaris accessorius*, (portion of the cubito-phalangeus of Gir.)—
- Position.** (Fig. 190, No. 12.)—This muscle is placed superficially on the posterior aspect of the limb, between the flexores metacarpi medius et externus, and extends from behind the elbow to the knee. It is composed
- Fleshy belly.** of a fleshy belly, terminated inferiorly by a tendon. The former is short and pyramidal, having a somewhat bulky superior extremity, from which it gradually diminishes, to terminate above the middle of the radius in a small flattened tendon. Numerous tendinous fibres
- Origin.** exist in its substance. It *arises* from the summit and posterior border
- Insertion.** of the olecranon, and by the lower end of its tendon joins that of the
- Relations.** perforans, behind the radio-carpal joint. Responding laterally to the external and median flexors of the metacarpus, the muscle is covered by the fascia of the fore-arm, and covers, in turn, the belly of the perforans.
- Action.** Its action is analogous to that of the preceding muscle.
- Dog.** *Differences.*—In the *dog* this is a semi-penniform muscle, which takes its origin from nearly the whole posterior aspect of the ulna.
- Radialis accessorius*, (portion of the cubito-phalangeus of Girard).
- Position.** —This is a small flattened muscle, lying directly on the posterior aspect of the radius in its inferior two-thirds. The muscular belly is covered on both its anterior and posterior aspects by a glistening
- Aponen-  
rosis.  
Structure.** aponenrosis. It is composed of muscular, intermixed with tendinous fibres, which converge slightly from above downwards, to terminate in a small tendon. Superiorly it is continuous for some distance on the upper third of the radius by some tendinous bundles, which are intimately adherent to the bone throughout their whole extent. It accordingly
- Origin.** *arises* from the upper and middle third of the radius, and is continued inferiorly by a small flattened tendon, which unites with that of the perforans immediately above the knee-joint. This tendon is confounded internally with the strong ligamentous band which extends from the radius to the perforatus. The radialis accessorius is related posteriorly to the perforans and anteriorly to the radius. It
- Termina-  
tion.  
Connection  
with the  
radial liga-  
ment.  
Relations.** acts with the last-named muscle in flexing the foot.
- Action.**
- Carnivora.** *Differences.*—In *dogs* this is a long fusiform muscle, arising from

the internal aspect of the superior extremity of the radius, and joining the perforans tendon behind the carpus.

#### SPECIAL MUSCLES OF THE FORE-ARM IN CARNIVORA.

Besides those already described, this class possesses five muscles of the fore-arm not found in the other domestic animals. These are the *extensor proprius pollicis et indicis*, *supinator longus*, *supinator brevis*, *pronator teres*, and *pronator quadratus*. Carnivora have five additional muscles in the fore-arm.

*Extensor proprius pollicis et indicis*, (extensor secundi internodii pollicis, and extensor indicis in man).—The extensor of the thumb and index is placed beneath *that of the three external digits*. Its body, which is very minute, *arises* from the external side of the radius along with the *extensor metacarpi obliquus*; the tendon by which it is terminated, crosses the anterior aspect of the knee beneath that of the common extensor, and enclosed in the same fibrous sheath with the latter. Beneath this it bifurcates, sending a division to be inserted on each of the two first digits, along with the corresponding divisions of the common extensor. Situation. Insertion.

*Supinator longus*.—This is represented by a very minute muscular bundle, situated beneath the homologue of the extensor metacarpi magnus, with which it *originates* from the epitrochlea; it is inserted inside the lower end of the radius by fleshy and aponeurotic fibres. This muscle acts, though to a very slight degree, in turning the anterior aspect of the carpus in an outward direction. Position. Origin and insertion. Action.

*Supinator brevis*.—This is a triangular muscle, situated beneath the homologue of the extensor metacarpi magnus, and the common extensor of the digits. It *originates* from a fossa in the axis of the humeral trochlea, and from this its fibres radiate downwards and inwards to be *inserted* on the anterior and internal aspects of the radius. Lying beneath the above-mentioned muscles, it covers the radius and elbow-joint. This is the chief supinator of the limb, having the same action as the last. Form and position. Origin. Insertion. Action.

*Pronator teres*.—The round pronator, situated on the supero-internal part of the fore-arm, between the extensor metacarpi magnus and flexor metacarpi internus, is a short, thick muscle, extending from a small tuberosity above the humeral condyle, to be *inserted* by tendinous fibres on the internal aspect of the radius. Situation, form, and attachments.

*Pronator quadratus*.—Situated beneath the muscles of the posterior brachial region, this muscle is in the form of an elongated parallelogram, the length of which corresponds to that of the fore-arm. Position, form and attachments.

Its fibres run from the posterior aspect of the radius directly across to the corresponding surface of the ulna.

Action.

The pronators are antagonist to the supinators, or, in other words, they rotate the radius in an inward direction, and so turn the dorsal aspect of the foot more anteriorly.

#### MUSCLES OF THE FOOT (ANTERIOR).

Two pairs of muscles.

In solipedes, two pairs of muscles are found in this region, the *lumbrici* and the *interosseous metacarpals*. Several ligamentous structures of this region must likewise be noticed.

Annular ligaments of the carpus.

The *annular ligaments* of the carpus (anterior and posterior) cover that joint in front and behind, bridging over the flexor and extensor tendons that pass over the articulation.

Anterior annular ligament.

The *anterior* is a strong ligamentous sheath, situated in front of the anterior common ligament of the carpus. It is continuous above with the brachial fascia, being formed by an increase of the transverse fibres of the latter, and is extended downwards by a thin fascia in front of the extensor tendons. This ligament extends from the internal aspect of the trapezoid, scaphoid, and radius, to the outer of the unciform, pisiform, and radius; it is also attached on the lateral aspects of the radius and anteriorly between each of the grooves for the extensor and two lateral flexor tendons, so that it forms a series of osteo-fibrous rings through which these tendons play. Each ring has a special synovial bursa.

Posterior annular ligament.

The *posterior annular ligament* or *carpal arch* is formed, like the anterior, by an increase in the transverse fibres of the brachial fascia, with which it is continuous. It is much stronger than the anterior, and, like it, is continued downwards by a fascia covering the flexor tendons, and which gradually diminishes in thickness. Attached internally on the radius, scaphoid, and trapezoid, it is fixed externally on the unciform and pisiform. Beneath this arch pass the tendons of the perforatus and perforans, the gliding of which is facilitated by a great synovial membrane extending some distance above the knee, and as far down as the lower third of the metacarpal bone.

Anterior aspect of the digits.

The dorsal aspect of the digital region is simply covered by a condensed connective tissue continuous with that covering the metacarpus. On the posterior aspect, however, we find two remarkable productions—the *sesamoid sheath* and the *posterior common digital ligament*.

Sesamoid sheath.

The *sesamoid sheath* is a strong layer of fibrous tissue covering the flexor tendons, on a level with the sesamoids and first phalanx. It is attached by three prolongations on each side to the lateral aspects



of the sesamoids, the head of the os suffraginis, and the glenoid fibro-cartilage of the os coronæ. The ring or tube formed by this membrane behind, and the sesamoidean groove, inferior sesamoid ligament, and glenoid fibro-cartilage in front, is covered by a synovial membrane, extending as high as the lower ends of the small metacarpal bones, and as low as the second phalanx, where it is only separated from that of the perforans and navicular bone by a transverse layer of yellow elastic tissue.

The *posterior common digital ligament* is a powerful expansion of white fibrous tissue, spread over the posterior aspect of the perforans tendon from a level with the first interphalangean articulation to its insertion. Its lower half is firmly attached to the latter tendon, with which it is inserted into the semilunar ridge. Superiorly it is attached by two strong fibrous prolongations to the lateral aspects of the first phalanx at its lower extremity.

Posterior  
common  
digital liga-  
ment;

its attach-  
ments.

*Lumbrici*, (posterior lumbrici, Per.)—These are two minute muscles, placed to the right and left of the perforans, in the lower third of the metacarpus. They seem to *originate* from the perforans, and to be *inserted* by their delicate tendons on the aponeurosis covering the sesamoids.

Position and  
attach-  
ments.

*Interossei metacarpi*, (anterior lumbrici, Per.)—Placed on the inner aspect of the small metacarpal bones, these muscles are longer but more delicate than the lumbrici. They *arise* from some connective tissue surrounding the heads of the small metacarpal bones, and are *inserted* by long delicate tendon on that of the extensor pedis, either directly or through the inferior prolongations of the suspensory ligament. These homologate the interosseous muscles of the lateral metacarpals, that of the median being transformed into the suspensory ligament.

Situation.  
Origin.

Insertion.

The use of these muscles is not very apparent. Rigot attributes to them the power of raising the synovial membranes of the pastern-joint and sesamoid sheath during flexion.

Action.

*Differences*.—*Ruminants* have no muscles in this region. The suspensory ligament, however, represents the interossei muscles of the two digits.

No such  
muscles in  
the ox.

*Carnivora*.—In these animals all the muscles of the human hand are reproduced, though in a much more rudimentary condition. These are—the *abductor pollicis*, *opponens pollicis manus*, *flexor brevis pollicis manus*, *adductor indicis palmaris brevis*, *abductor minimi digiti manus*, *flexor brevis minimi digiti*, *opponens minimi digiti*, three lumbrici, and four interossei metacarpi.

Dog's foot.

- Position, structure, and attachments.** *Abductor pollicis*.—Placed behind the internal metacarpal bone, this is a rudimentary muscle, consisting of pale and delicate fleshy bundles, *attached* superiorly upon the carpal arch, and terminating inferiorly by some tendinous fibres on the metacarpal bone and superior extremity of the first phalanx. It flexes and abducts the internal rudimentary digit.
- Action.**
- Situation, structure, and attachment.** *Opponens pollicis manus*.—Situated on the internal aspect of the internal metacarpal bone, beneath and to the inner side of the last muscle, this is formed of pale fleshy fibres, directed downwards and outwards from their *origin* on the posterior common ligament of the carpus, to the metacarpal of the internal digit. The position of the rudimentary thumb prevents this muscle bringing it in opposition to the fingers as in man; it is simply an adductor of that digit.
- Use.**
- Situation, form, and attachments.** *Flexor brevis pollicis manus*.—Situated between the preceding, the adductor indicis and the interossei muscles, this is a minute muscle, formed of deep red fibres. Taking its *origin* from the posterior common ligament of the carpus, it is *attached* inferiorly to the superior extremity of the first phalanx on its internal aspect. It flexes the thumb actively.
- Use.**
- Situation, outline, and connections.** *Adductor indicis*, (adductor pollicis manus in man).—Placed between the interossei muscles of the second and third digits, and covered by the tendinous portion of the flexor communis digitorum, this is an elongated prismatic muscle, somewhat compressed from side to side. It is *attached* superiorly with the second interossei on the posterior common carpal ligament, and inferiorly by a small flattened tendon on the supero-internal part of the first phalanx of the index.
- Action.** This muscle adducts the index digit.
- Structure, position, and connections.** *Palmaris brevis*.—This is a thick musculo-adipose mass, placed behind the carpus, where it bulges slightly externally. Throughout its course it is intimately adherent to the skin, and to the aponeurosis covering the deeper-seated muscles.
- Position and form.** *Abductor minimi digiti manus*.—Situated superficially on the postero-external aspect of the outer metacarpal bone, this muscle has a thick conical fleshy body, with a concave anterior and convex posterior aspect, which terminates inferiorly by a long flattened tendon.
- Origin.** *Arising* from the external aspect of the pisiform bone, it is *inserted*
- Insertion.** outside the superior extremity of the first phalanx. As its name
- Use.** would indicate, this muscle abducts the external digit.
- Position, etc.** *Flexor brevis minimi digiti*.—Placed on the inner aspect of the last, in a direction from above downwards and slightly outwards, this

is a triangular muscle, flattened from before backwards, and almost entirely fleshy. It *arises* from the ligament extending between the pisiform and the metacarpus, and is *inserted* on the tendon of the abductor. This is an abductor, and, to a slight extent, a flexor of the fifth digit. Connections.

*Opponens minimi digiti*.—Situating between the tendon of the perforans and the third interosseous muscle, in a downward and slightly outward direction, this is a small muscle, flattened from before backwards. It *originates* from the posterior common carpal ligament, and is *inserted* by tendon to the inner aspect of the upper extremity of the first phalanx. This is an adductor of the external digit. Position.  
Origin.  
Insertion.  
Use.

*Lumbrici*.—These are *three little muscles* included in the intervals between the four principal branches of the perforans tendon, and receiving their name from the resemblance they bear to earthworms. They *arise* from the perforans tendon, and are *inserted* in some cases on the inner aspect of the first phalanges of the three external digits, in others on the extensor tendons of the same digits. Number,  
position,  
and appearance.  
Attachments.

*Interossei metacarpi*.—These are *four muscular bundles*, placed parallel to each other on the posterior aspect of the four principal metacarpal bones and in front of the perforans tendon, from which they are separated by a layer of aponeurosis. They are thick, prismatic, and bifid inferiorly. Each *arises* from the posterior and lateral aspects of the corresponding metacarpal bones, the posterior common carpal, and the intermetacarpal ligaments. Inferiorly the two portions are *inserted* on the lateral aspects of the small sesamoids of the same digit, and from these a tendon is continued forwards on each side, to join the principal extensor tendon of that toe. They prevent undue extension of the digits while standing, retain the extensor tendons on the anterior aspect of the phalanges, and flex the digital upon the metacarpal bones. Number,  
position,  
and form.  
Origin.  
Insertion.  
Use.

*Pig*.—In this animal we find a *flexor brevis minimi digiti*, one *lumbricus*, and *four interosseous metacarpal*. Fig.

*Flexor brevis minimi digiti*.—This muscle *originates* from the same point as in the *dog*, and is *inserted* on the external sesamoid and extensor tendon of the small external digit by a fibrous band, which becomes confounded with the external tendon of the corresponding interosseous muscle. Attachments, etc.

The single *lumbricus* is a comparatively large muscle, *arising* from Lumbricus.



the perforans, and *inserted* on the principal extensor tendon of the internal digit, in the same way as the last muscle.

*Interossei.* The *four interossei metacarpal* muscles resemble those of the dog in their *origin* and *insertion*. Those belonging to the two smaller digits are not only bifid inferiorly, but are divided throughout into two distinct parts, of which the external are superficially, and the internal deeply situated. The aponeurosis separating them from the perforans tendons is much thicker than in carnivora.

### MUSCLES OF THE HIND LIMBS.

These may, like those of the fore-limbs, be divided into four groups, mainly, 1st, the muscles of *the haunch*; 2nd, those of *the thigh*; 3rd, those of *the leg*; and 4th, those of *the foot*.

#### REGION OF THE HAUNCH (GLUTEAL).

Three  
gluteal  
muscles.

Gluteal  
fascia.

In this region we find three large muscles, the *gluteal*, placed one above the other, and distinguished as the *external*, *median*, and *internal*. These muscles are covered *externally* by a strong aponeurosis. This aponeurosis, continuous anteriorly with that of the longissimus dorsi, is attached on the external angle of the ilium and sacral spine, while inferiorly it is extended over the posterior crural region, becoming confounded with the superficial layer of the fascia lata. Closely attached to the skin in some parts of its external border, its internal gives insertion to numerous muscular bundles of the *glutei externus* and *medius*.

*Dissection.*—Place the subject on its side or belly, and remove the skin from the whole region, in order to study the extent and attachments of the gluteal fascia. Next carefully dissect this fascia from the surface of the muscles, leaving that part which attaches the *gluteus externus* to the ilium and sacrum, cut through the sacral attachment of the *abductor femoris*, and reflect that muscle downwards, that the *gluteus externus* may be exposed. To expose the *gluteus medius*, the *externus* must be cut through close to its femoral and outer iliac insertions, and turned back upon the sacral spine. Lastly, by dividing the *gluteus medius* towards its trochanterian insertion, carefully dissecting it from the parts beneath, and reflecting it upwards and forwards, the deep muscle may be studied.

*Gluteus externus*, (*ilio-trochanterius medius*, Gir.; *gluteus minor*, Bourg.; *gluteus medius*, Lafosse and Rigot; *gluteus magnus* in man).

Position.

—(Fig. 176, No. 27; Fig. 193, No. 2.)—Placed on the postero-superior



Fig. 193.

POSTERIOR VIEW OF THE SUPERFICIAL MUSCLES OF THE HIND LIMBS.

- |   |  |                                 |
|---|--|---------------------------------|
| 1. Gluteus medius.                                | 6. Semitendinosus.                                 | 10. Internal belly of the same. |
| 2. Gluteus externus.                              | 7. Semimembranosus.                                | 11. Flexor pedis perforans.     |
| 3. Tensor vaginae femoris.                        | 8. Posterior head of the triceps abductor femoris. | 12. Peroneus.                   |
| 4. Vastus externus.                               | 8'. Median head of the same.                       | 13. Extensor pedis.             |
| 5. Anterior head of the triceps abductor femoris. | 9. External belly of the gastrocnemius.            |                                 |

Muscular portion is V-shaped.	aspect of the haunch, this muscle is composed of a fleshy portion, situated under the gluteal fascia, and aponeurotic, covered by the abductor femoris. The muscular part has a triangular form, but is divided superiorly into two branches, an internal and an external, which give it a V-shaped appearance. Its component muscular bundles are loosely connected together, and running backwards and downwards, converge to a flattened tendon at the inferior angle of the muscle. The aponeurosis, likewise triangular, is continuous in front with the posterior border of the muscular portion; and degenerates into areolar tissue on the surface of the sacro-sciatic ligament.
Its structure.	
Aponeurosis.	
Origin.	This muscle <i>originates</i> from the internal aspect of the gluteal fascia, and through this from the external angle of the ilium and sacral spine; also by its aponeurotic portion, from the outer aspect of the sacro-sciatic ligament and outer border of the ischium. Inferiorly its tendon is <i>inserted</i> on the small external trochanter of the femur.
Origin of fascia.	
Insertion.	
Relations.	This muscle is covered by, and intimately connected with the gluteal fascia and abductor femoris, internally it responds to the gluteus medius. Its anterior border is continuous in its superior half with the tensor vaginae femoris.
Action.	The gluteus externus is a true abductor of the thigh.
Ox and pig.	<i>Differences.</i> —In <i>ruminants</i> and <i>pigs</i> , this muscle is completely
Carnivora.	amalgamated with the abductor femoris. In <i>carnivora</i> this muscle is largely developed. Its greater part <i>arises</i> from the sacrum, along with the tendon of the abductor magnus, a small slip only being received from the external iliac spine. It is inserted on the posterior aspect of the great trochanter, and for some distance down the femur. It does not join the tensor vaginae, as in the horse.
Position.	<i>Gluteus medius</i> , (ilio-trochanterius magnus, Gir.; gluteus maximus, Bourg.)—Fig. 176, No. 24; Fig. 193, No. 1.)—This is the largest of the gluteal muscles. It is situated on the superior aspect of the haunch, covered posteriorly by the last muscle occupying the whole iliac fossa, with part of the external aspect of the sacro-sciatic ligament, and sending a prolongation forwards upon the loins, where it is received into a depression in the longissimus dorsi. It is of an irregular rhomboid form, elongated from before backwards, very thick in its median part, prolonged forwards by a flattened pointed portion, and divided posteriorly into three parts, of which two are muscular, and one aponeurotic. Its fibres converge more or less to its posterior insertions.
Form and structure.	
Origin.	It <i>arises</i> from the gluteal and lumbar aponeuroses, the fascia of



the longissimus dorsi, the internal and external angles of the ilium, together with the dorsum of the same bone; also from both sacro-iliac and part of the sacro-sciatic ligament. The anterior division is *inserted* by a flat tendon on the summit of the trochanter major; the median also by tendon on the crest behind the trochanter, after having played over the summit by the aid of a synovial bursa; the posterior is a thin musculo-aponeurotic slip, passing over the trochanter major, to be inserted on the posterior aspect of the femur, between the two small trochanters.

Insertions of  
the anterior,

median,

and poste-  
rior divi-  
sions.

Covered by the gluteus externus, with the lumbar and gluteal fasciæ, this muscle responds by its deep aspect to the longissimus dorsi, the iliac fossa, the sacro-iliac, and sacro-sciatic ligaments, the gluteus internus, the gluteal and sciatic nerves, and the gluteal vessels. Close to the external angle of the ilium, it is related by its external border to the iliacus and tensor vaginæ femoris, from which it is with difficulty separated.

Relations.

When the pelvis is the fixed point, this muscle extends and abducts the femur; when the femur is fixed, it will assist in elevating the trunk, as in the act of rearing.

Action.

*Differences.*—In *ruminants* the gluteus medius does not extend so far forwards as in *solipedes*. In the *pig* the anterior prolongation is even shorter. In the *dog* there is no prolongation in front of the ilium, and the muscle is not divided posteriorly. It gains the summit of the trochanter major by a short tendon, the external part of which has a synovial bursa.

ox.

Fig.

Dog.

*Gluteus internus*, (ilio-trochanterius parvus, Gir.; gluteus medius, Bourg.; gluteus minimus, Lafosse).—(Fig. 184, No. 17.)—Situated beneath the last muscle above the hip-joint, this is a short, thick quadrilateral muscle, flattened from above downwards. Its fibres, which are thickly intermixed with tendon, converge from their internal to their external attachment. They arise from the neck of the ilium and supra-cotyloid crest, and are *inserted* on the anterior concave aspect of the trochanter major.

Situation  
and form.

Structure.

Origin.

Insertion.

It responds externally to the gluteus medius, to which it is intimately attached, but from which it is easily distinguished by its more tendinous structure. Internally it covers and is intimately adherent to the capsular ligament of the hip-joint; it is separated from the external tendon of origin of the rectus femoris by a strong aponeurotic layer, extending from the external border of the ilium to the base of the trochanter major.

Relations.

**Action.** The gluteus internus abducts the femur, and slightly rotates it forwards and inwards.

**Ox and pig.** *Differences.*—In *ruminants* and *pigs* this muscle is relatively larger than in the horse, and is partially divisible into two portions. It takes its origin from the internal border of the ilium as well as from the supra-cotyloid crest. In *carnivora* it is relatively large, *originating* from the posterior third of the dorsum ilii, as well as to the supra-cotyloid crest, and is inserted by tendon on a small tubercle outside the base of the trochanter major.

**Small rotators of the femur.** A *separate group of small muscles* are deeply situated beneath the glutei on the posterior and internal aspects of the hip-joint. These are the *pyriformis*, *two obturators*, *two gemini*, and the *quadratus femoris*.

*Dissection.*—By removing the gluteal muscles, most of these will be brought into view; the pyriformis and obturator internus, however, cannot have their pelvic attachment studied without opening that cavity.

**Position,  
form, and  
structure.**

*Pyriformis*, (sacro-trochanterius, Gir.; pyramidalis).—Placed inside the pelvis, on the inner aspect of the ilium, and extending as far outwards as the base of the trochanter major, this is a small penniform muscle, flattened from within outwards, and continued posteriorly by a tendon common to this and the obturator internus. Its fleshy belly is *attached* anteriorly to the internal aspect of the ilium, close to the ischiatic border, and to the antero-external angle of the sacrum, and its tendon, which unites with that of the obturator internus before its escape from the pelvis, is *inserted* along with the latter into the trochanterian fossa.

**Origin.**

**Insertion.**

**Relations.**

Within the pelvis the pyriformis is related externally to the ilium, and internally to the peritoneum, rectum, sacral plexus, obturator artery, and nerve and artery of the bulb. Outside the pelvis it responds posteriorly to the gluteus medius and sciatic nerve, anteriorly to the gemini. The common tendon has a synovial membrane to facilitate its gliding over the border of the ischium.

**Ruminants.**

*Differences.*—In *ruminants* it has no intra-pelvic portion, but originates with the gemini from the external border of the ischium.

**Situation.**

**Form and  
structure.**

**Origin.**

*Obturator internus*, (subpubio-trochanterius internus).—As in the case of the pyriformis, this muscle is, with the exception of its tendon of insertion, included within the pelvis. It is flat, thin, and radiating, its fibres converging from within outwards and downwards. These *arise* from the circumference of the obturator foramen, on its internal

aspect, and are *inserted* by the common tendon of this and the pyriformis to the trochanterian fossa. Insertion.

Its fleshy part responds inferiorly to the pubis, ischium, and external obturator; superiorly to a layer of white fibrous tissue, by which it is separated from the bladder and peritoneum. The relations of its tendon were described with the last muscle. Relations.

The action of this muscle and the last is to rotate the femur outwards. These two seem to oppose the obturator externus and ischiofemoralis in producing a slight abduction of the leg. Action of these muscles.

*Differences.*—In *ruminants* and *pigs* this muscle passes through the obturator foramen, and goes to be inserted on the femur with the obturator externus. In the *dog* it resembles that of the horse. Ox and pig. Dog.

*Obturator externus*, (snubpubio trochanterius externus, Gir.)—Placed horizontally beneath the pelvis, from the obturator foramen to the superior extremity of the femur, this is a short, thick, triangular muscle, flattened from above downwards, and wholly muscular, except towards its insertion. Its delicate fibres *arise* from the margin of the obturator foramen on its external aspect, and are *inserted* by a small tendon in the trochanterian fossa. Situation and form. Structure. Origin. Insertion.

Its inferior aspect responds to the adductors femoris, the pectineus, and quadratus femoris; its superior to the capsular ligament of the hip and the obturator internus. This muscle adducts the femur, and rotates it slightly, turning its anterior part outwards. Relations. Action.

*Gemini*, (ischio-trochanterius, Gir.)—Two, and in some cases three small muscular slips extend from the antero-external angle of the ischium to the trochanterian fossa. They *arise* from the external border of the ischium, and are placed one above and one below the common tendon of the pyriformis and obturator internus, upon which they take their *insertion* previous to its reaching the trochanterian fossa. One portion is sometimes *inserted* in the latter depression without joining the pyriformis tendon. Enveloping the above-mentioned tendon, they respond posteriorly to the sciatic nerve, and anteriorly to the obturator externus and capsular ligament of the hip-joint, from both which they are separated by a layer of adipose tissue. Number and position. Origin. Insertion. Relations.

These act with the two muscles whose tendon they cover in rotating and slightly abducting the femur. Action.

*Differences.*—In the *dog* the gemini are two small muscular slips, arising from the inferior aspect of the ischiatic tuberosity, and inserted on the ridge that bounds the trochanterian fossa externally. Dog.



Form and situation.	<i>Ischio-femorals</i> , (gracilis internus, Bourg.; quadratus femoris).—(Fig. 184, No. 23.)—This is a small, flat, muscular band, situated from above downwards and outwards, on the posterior aspect of the femur and between the adductor magnus and the obturator externus. It
Structure.	is composed of parallel fleshy fibres, interspersed with tendon towards
Origin.	its inferior extremity. It takes its <i>origin</i> from the inferior aspect of
Insertion.	the ischium, in front of the ischiatic spine, and is <i>inserted</i> in a linear depression on the superior third of the posterior aspect of the femur.
Relations.	It responds posteriorly and internally to the adductor magnus, anteriorly to the obturator externus, and externally to the gemini.
Action.	This is an extensor of the femur; it also adducts that bone, but can scarcely be said to assist in rotation.

## ANTERIOR FEMORAL REGION.

Contains three muscles.	This region contains three muscles, namely, the <i>tensor vaginæ</i> , <i>triceps extensor cruris</i> , and <i>ilio-femoralis</i> .
-------------------------	---

*Dissection.*—In dissecting this region the subject may be placed on his back, and the skin removed from the anterior aspect of the thigh; by this means the tensor vaginæ and fascia lata will be exposed. After these have been sufficiently studied, they may be removed together with the gluteus externus, sartorius, and gracilis. The three principal heads of the triceps thus exposed may be separated from each other, commencing below where they are more distinct, and leaving off only where they become inseparable. Lastly, by raising the rectus from its superior attachment, the ilio-femoralis may be studied.

Direction, situation, form, and structure.	<i>Tensor vaginæ femoris</i> , (ilio-aponeuroticus, Gir.; musculus fasciæ latæ, Rig.)—(Fig. 176, No. 25; Fig. 193, No. 3.)—Directed from above downwards and backwards on the antero-external aspect of the thigh, the tensor vaginæ is a broad, flat, triangular muscle, intersected by layers of aponeurosis, and covered by a thick fascia. The
Origin.	fibres <i>originate</i> along with the gluteus externus from the external angle of the ilium, and radiating downwards, end in the <i>fascia lata</i> on a level with the middle third of the femur.
Terminate in the fascia lata.	The <i>fascia lata</i> , with which this muscle is continuous, is a strong fibrous expansion, spread over the anterior, posterior, and lateral
Fascia lata.	aspects of the thigh. It is composed of two layers, the deeper of which runs between the vastus externus and abductor femoris, to gain the small external trochanter in company with the gluteus externus.
Deep layer; its connections.	The <i>superficial</i> covers the two vasti, the rectus, and the triceps abductor femoris; over the latter it is continuous superiorly with the gluteal fascia, while internally it degenerates into connective
Superficial layer; its connections.	

tissue, by which it is continuous superiorly with Poupart's ligament. Inferiorly it is inserted on the patella, but is partially continued down the outer aspect of that bone, to be inserted on the tibia along with the triceps.

The *tensor vaginae* responds externally to the skin, and internally Relations. to the iliacus, rectus, and vastus externus; its posterior border can only be separated artificially from the gluteus externus. The anterior aspect of the fascia lata gives insertion to the abdominal panniculus.

This muscle draws the fascia lata upwards, rendering it tense. It Action. also flexes the femur on the pelvis, pulling the limb upwards and forwards.

*Differences.*—In *ruminants*, and more especially in *pigs*, this Ox and pig. muscle is comparatively longer and broader than in the horse. In *carnivora* the median aponeurotic band is represented by a separate Dog and cat. fusiform muscle, distinct at all points from the tensor vaginae, and extending between the external angle of the ilium and the anterior aspect of the patella. The other portion exactly represents the tensor vaginae of the horse.

*Triceps extensor cruris*, (quadriceps extensor cruris in man).—The three great muscular masses covering the whole anterior, internal, and external aspects of the femur are so confounded with each other inferiorly, that it would seem preferable to follow the example of human anatomists in considering them as heads of a single muscle. We still, however, retain the names, *rectus femoris*, *vastus internus*, and *vastus externus*.

*a.*—The *rectus femoris*, (ilio-rotuleus, Gir.)—(Fig. 184, No. 19; Fig. 194, No. 8),—lies along the front of the femur, in a direc- Position. tion from above downwards and backwards, and between the two vasti muscles. It is an elongated fusiform muscle, of great thickness Form and structure. in its median part, and formed of deep red muscular, intermixed with tendinous fibres; its inferior half is covered anteriorly and laterally by aponeurosis. The rectus is *attached* superiorly by two Origin. short flattened tendons to the inner and outer sides of the neck of the ilium, immediately in front of the acetabulum; it is terminated inferiorly by a short thick tendon, *inserted* on the anterior aspect of Insertion. the patella. Related laterally to the two vasti, it is covered ante- Relations. riorly by the tensor vaginae, and responds posteriorly to the capsular ligament of the hip-joint, the ilio-femoralis, and the lower third of the vasti muscles, from which it shows no true separation.

*b.*—*Vastus internus*, (vastus internus and crureus).—(Fig. 194,

**Position, form, and structure.** No. 7.)—Situated on the antero-internal aspect of the femur, and extending from the neck of the femur to the patella, this is a large muscular mass, flattened from side to side, and mixed up with numerous tendinous fibres. A few bundles at its infero-internal part, partially separated from the rest by a layer of aponeurosis, represents the *crureus*. The whole is covered anteriorly and internally by a thin aponeurosis. Its fibres *originate* from the whole inner half of the anterior aspect of the femur, and are *inserted* partly on the tendon of the rectus, and partly on the capsular ligament of the patella, together with the superior and internal aspects of the same bone, in company with the vastus externus. It responds internally to the fascia lata, sartorius, iliacus, pectineus, and adductor magnus, externally to the vastus externus and rectus, while posteriorly it lies in contact with the femoral bone.

**Homologue of the crureus.**

**Origin.**

**Insertion.**

**Relations.**

**Outline.** c.—*Vastus externus*.—(Fig. 176, No. 26; Fig. 184, No. 18; Fig. 193, No. 4.)—This is a broad, thick, muscular mass, somewhat less than the last, but otherwise closely resembling it. It is situated on the antero-external aspect of the femur throughout the entire length of that bone. This muscle contains numerous tendinous fibres towards its superior extremity, and its anterior and external aspects are covered by an aponeurosis. Its fibres *arise* from the whole outer half of the anterior aspect of the femur, run downwards and forwards, becoming confounded internally with the rectus, and are *inserted* on the superior and external aspects of the patella. The vastus externus responds externally to the tensor vaginæ, fascia lata, and gluteus externus; internally to the rectus and vastus internus, with both which it is confounded in its lower half; and posteriorly to the femur and abductor femoris.

**Structure.**

**Origin.**

**Insertion.**

**Relations.**

**Action of the three heads.** *Action*.—The three heads of this muscle constitute, where united, one of the most powerful muscular masses in the body. They extend the leg, and through the pelvic attachment of the rectus, flex the femur, and bring the whole limb forwards under the body.

**Ox and dog.** *Differences*.—In *ruminants* the three portions of the triceps are more distinct from each other. In the *dog* the rectus is attached superiorly by a single tendon to the subpubian tubercle, above and in front of the acetabulum.

**Situation, form, and structure.** *Ilio-femoralis*, (gracilis antierius, Rig.)—Situated between the rectus and the capsular ligament of the hip-joint, the ilio-femoralis is a small fusiform muscle, tendinous at its extremities. It *arises* from the neck of the ilium, outside the external tendon of the rectus, and

**Origin.**



is *inserted* by a flattened tendon, which insinuates itself between the two vasti, on the anterior aspect of the femur, in its superior fourth. Enclosed in front and on each side by the triceps, and firmly attached posteriorly to the capsular ligament of the hip-joint, the use of this muscle, it has been suggested, is to raise the capsule, and prevent it being pinched during flexion of this joint.

## INTERNAL FEMORAL REGION.

This region comprises five muscles—the *sartorius*, *gracilis*, *pectineus*, *adductor magnus*, and *adductor brevis*. These are arranged in two layers, a *superficial*, containing the two muscles first named, and a *deep*, embracing the three latter.

*Dissection*.—Place the subject in the first position, and remove the skin and fascia lata inside the thigh, together with the inferior wall of the abdomen. On the opposite side the same may be accomplished, and the two superficial muscles having been cut across, may have their different parts raised and reflected backwards so as to expose the deeper layer. To study the adductor magnus, it may be further necessary to remove the *semimembranosis*.

*Sartorius*, (sublumbo-tibialis, Gir.; adductor longus cruris, Rig.)—(Fig. 185, No. 8.)—Situated partly within the abdomen and partly inside the thigh, the sartorius is a flattened muscular band, extending backwards, downwards, and outwards from the sublumbar region to the stifle-joint. It is formed of parallel muscular fibres, spread out anteriorly, but becoming narrower posteriorly, and terminated by an aponeurosis, confounded with that of the gracilis. *Arising* from the sublumbar fascia and the tendon of the psoas parvus, it takes its *insertion* on the internal ligament of the patella, along with the gracilis and fascia lata.

This muscle is covered by the lumbo-iliac aponeurosis, Poupart's ligament, and the fascia lata; it covers in turn the psoas magnus, iliacus, vastus internus, the anterior femoral nerve, and anterior muscular arteries of the thigh. Its posterior border forms the anterior boundary of a triangular space, containing the crural vessels, while lower down its anterior border is confounded with the gracilis.

This muscle adducts the limb, and flexes the femur.

*Differences*.—In *ruminants* the sartorius is bifid superiorly, the additional head *arising* from the ilium. The femoral artery passes between the two heads. In *carnivora* it *arises* from the external angle of the ilium, and by a few fibres only from the psoas fascia. It

is *inserted* on the internal lateral ligament of the stifle and the tibial crest.

Position and form.	<i>Gracilis</i> , (sub-pubio-tibialis, Gir.; adductor brevis cruris, Rig.)—(Fig. 185, No. 9.)—Placed subcutaneously on the inner aspect of the thigh, and behind the sartorius, this is a broad, flat, quadrilateral muscle, becoming thinner towards each of its borders, and extending from above downwards and outwards. The muscular portion is formed
Structure.	of fibres running parallel to each other in the same direction as the muscle, and is enclosed in a special aponeurosis. Its superior border is continuous with a very broad flattened tendon, its inferior, with two extensive aponeuroses, a superficial and a deep.
Origin.	Its superior tendon is <i>attached</i> to the ischio-pubic symphysis, after being confounded with that on the opposite side, becoming continuous in front with the pubic tendon of the abdominal muscles. Inferiorly its deeper and stronger aponeurosis, joining that of the sartorius, is
Insertion.	<i>inserted</i> on the internal ligament of the patella, while posteriorly it joins the aponeurosis of the semitendinosus, to form a sheath for the
Superficial aponeurosis.	tibial muscles. The superficial aponeurosis, continued from that covering the external aspect of the muscle, is prolonged by a subcutaneous fascia, situated over the front of the stifle and tibial region.
Relations.	Covered by the fascia lata, with the saphena vein and nerve, which latter cross it diagonally from before backwards, the gracilis responds internally to the pectineus, adductors femoris, semimembranosus, semitendinosus, and internal lateral ligament of the stifle. The anterior border of this muscle, with the posterior margin of the sartorius, form two sides of a triangular space, containing the femoral artery and vein, with numerous lymphatic glands.
Action.	This muscle adducts the limb, and renders tense the tibial aponeuroses.
Dog.	<i>Differences</i> .—This muscle is somewhat narrower and thinner in the dog.
Situation and outline.	<i>Pectineus</i> , (super-pubio-femoralis, Gir.; pectineus and adductor longus in man).—(Fig. 185, No. 10; Fig. 194, No. 3.)—Situated on the antero-internal aspect of the femoral region, beneath the anterior border of the gracilis, the pectineus is a long fusiform muscle, directed from above downwards, backwards, and outwards, and slightly flattened from before backwards. The muscle is formed of bright red
Structure.	muscular fasciculi, is divisible into two portions towards its superior extremity, and covered at its lower end by tendinous fibres, which converge to form a single cord of attachment. It <i>arises</i> from the ante-
Origin.	

rior border and inferior aspect of the pubis, from the common prepu-  
 bian tendon of the abdominal muscles, and from the pubio-femoral  
 ligament, which is embraced between its two portions. Its inferior  
 tendon is *inserted* on the crest beneath the trochanter minor in- Insertion.  
 ternus.



Fig. 194.

INNER SIDE OF THE HIND-LIMB, WITH THE SUPERFICIAL  
 MUSCLES REMOVED.

- |                                     |   |
|-------------------------------------|---|
| 1. External portion of the iliaens. | 8. Rectus femoris.                      |
| 2. Internal portion of the same.    | 9'. Internal head of the gastrocnemius. |
| 3. Pectineus.                       | 9. External head of the same.           |
| 4. Adductor parvus.                 | 10. Popliteus.                          |
| 5. Adductor magnus.                 | 11. Flexor pedis accessorius.           |
| 6' 6. Semimembranosis.              | 12. Flexor pedis.                       |
| 7. Vastus internus.                 | 13. Flexor metatarsi.                   |



- Relations.** It responds internally to the *gracilis* and femoral artery and vein, antero-externally to the *psoas magnus*, *iliacus*, and *vastus internus*, and posteriorly to the *obturator externus* and *adductor parvus*.
- Action.** The *pectineus* flexes and adducts the femur; it also rotates it slightly outwards.
- Ruminants.** *Differences.*—In the other domestic animals this muscle is not bifid superiorly. In the *ox* it is divided inferiorly, the additional prolongation going to the internal condyle of the femur. In the *dog* it is *inserted* by tendon on the lower third and internal condyle of the femur.
- Dog.**
- Position and outline.** *Adductor parvus*, (part of the *biceps femoralis* of Bourgelat; and subpubio-femoralis of Girard).—(Fig. 194, No. 4.)—Situated on the internal aspect of the femur, between the *pectineus* and *adductor magnus*, this is a long muscle, flattened from before backwards, narrowed, but somewhat thickened at its superior extremity; thin and expanded inferiorly. Its direction is from above downwards and outwards.
- Structure.** Its superior portion is formed of light-coloured fleshy fibres, running parallel to each other, and terminating in an aponeurosis inferiorly.
- Origin.** *Arising* superiorly from the inferior aspect of the pubis, and by the tendon common also to the *gracilis*, from the symphysis pubis.
- Insertion.** the *adductor parvus* is *inserted* on the quadrilateral roughened space on the posterior aspect of the femur, along with the *adductor magnus*.
- Relations.** Covered on its internal aspect by the *gracilis*, this muscle responds externally to the *obturator externus*; anteriorly to the *pectineus*, and posteriorly to the *adductor magnus*. It acts with the next muscle in adducting, extending, and rotating the femur.
- Action.**
- Ox.** *Differences.*—In *ruminants* it is more confounded with the next muscle. In the *dog* it is easily separated from the latter, and is *inserted* on the internal small trochanter and the whole postero-internal aspect of the femur beneath that point.
- Dog.**
- Situation, form, and structure.** *Adductor magnus*, (portion of the *biceps femoralis* of Bourgelat, and subpubio-femoralis of Girard; *adductor longus*, Per.)—(Fig. 194, No. 5.)—Placed behind the last muscle, in front of the *semimembranosus* and beneath the *gracilis*, the *adductor magnus* is a long, thick, prismatic muscle, extending from above downwards and outwards. It is thinnest in an antero-posterior direction, divided inferiorly into two portions of unequal size, and is almost exclusively composed of pale-coloured muscular fibres running parallel to each other.
- Origin.** It *originates* superiorly from the inferior surface of the ischium, and by the tendon common also to the *gracilis*, from the symphysis

ischii. Inferiorly the external division, the larger, is *inserted* by Insertions. short tendinous fibres on the quadrilateral roughened portion of the femur along with the adductor brevis; the internal, longer and thinner, is *inserted* on the supero-internal aspect of the inner condyle, along with the semimembranosis, and on the internal lateral ligament of the stifle.

It responds internally to the gracilis, posteriorly to the semimem- Relations. branosis, and anteriorly to the adductor parvus, the obturator externus, the lower end of the quadratus femoris, and by its internal portion to the vastus internus. Its internal border responds in part to the quadratus femoris, and is separated by a thin aponeurosis from the sciatic nerve and biceps abductor femoris. Between its two heads pass the femoral artery and vein. This muscle, like the last, ex- Action. tends, adducts, and rotates the femur.

*Differences.*—In *ruminants* and *pigs* this muscle is not bifid in- Ox and pig. feriorly, but terminates by a single head on the posterior aspect of the femur. In *carnivora* it is divided inferiorly, the external head being Carnivora. attached to nearly the whole length of the femur posteriorly, and the internal to the corresponding condyle, as in the horse.

#### POSTERIOR FEMORAL REGION.

This region contains two single muscles and a triceps, which together form the posterior prominence of the thigh. These are the *semimembranosis*, the *semitendinosus*, and the *triceps abductor femoris*.

*Dissection.*—Place the subject in the first position, loose one hind-limb from the bar, and turn the body slightly to that side; pull the opposite limb forwards to put the muscles on the stretch. The gracilis may then be cut through transversely, and reflected so as to expose the semimembranosis, which may now be examined. Next remove the aponeurosis of the latter muscle from the surface of the semitendinosus and triceps, and study the former muscle. Afterwards detach the semitendinosus from its superior attachment, to expose the corresponding insertion of the triceps; isolate the two heads of the latter muscle, and after having studied its general characters, bisect it, and reflect the divided portions in order to study its internal aspect.

*Semimembranosis*, (ischio-tibialis internus, Gir.; adductor magnus, Situation and direction. Per.)—(Fig. 176, No. 32; Fig. 185, No. 13; Fig. 193, No. 7; Fig. 194, Nos. 6, 6.)—Placed on the postero-internal aspect of the thigh, beneath the gracilis, and between the adductor magnus and semitendinosus, this is a vertically elongated muscle, extending obliquely from the posterior circumference of the pelvis downwards, forwards, and outwards, to the lower end of the femur. It is somewhat prismatic

- Outline. in form, with a thick anterior and a thin posterior border. Its superior extremity is bulky, with the exception of a small aponeurotic prolongation which ascends along with the gluteal aponeurosis to gain the root of the tail. The body of the muscle gradually decreases in size from above downwards, and terminates inferiorly in a short flattened tendon. If we except the extremities, the muscle is exclusively formed of muscular fibres.
- Structure.
- Origin. It is *attached* superiorly by its prolongation to the aponeurosis of the coccygeal muscles, and through this to the spine of the sacrum, by its body to the tuberosity and inferior aspect of the ischium. Its
- Insertion. terminal tendon is *inserted* on a small tubercle inside the internal condyle of the femur.
- Relations. It responds internally to the gracilis and a thin fascia continuous with the gluteal aponeurosis, externally to the triceps abductor, semitendinosus and sciatic nerve, posteriorly to the last-named muscle, and anteriorly to the adductor magnus, from the substance of which
- Action. no true natural separation can be made. This muscle adducts and extends the femur when the pelvis is a fixed point. When the femur is fixed it assists in the act of rearing.
- Fig. *Differences.*—In no domestic animal other than solipedes and the pig is this muscle prolonged to the sacrum. In the latter animal the extension is very rudimentary. In *ruminants* and *carnivora* the semimembranosus divides into two heads opposite the upper third of the femur; of these, the anterior becomes inserted on the inner condyle, the posterior on the internal tubercle on the head of the tibia, to gain which it passes beneath the corresponding lateral ligament.
- Ox and carnivora.
- Situation. *Semitendinosus*, (ischio-tibialis medius, vel posterior, Gir.)—(Fig. 176, No. 31; Fig. 185, No. 14; Fig. 193, No. 6.)—Situated on the posterior aspect of the femoral region, between the semimembranosus and the triceps, this muscle extends from the spine of the sacrum to the tibia, describing, in its course, a curve, with the convexity posteriorly. It is smaller than the muscle last described, is bifid at its superior extremity, attains its greatest bulk when the two heads unite, diminishes gradually in thickness from above downwards, and terminates inferiorly in an aponeurosis and flattened tendon. As a whole, it is somewhat prismatic, but is compressed from within outwards. If we except the extremities, it is almost entirely muscular.
- Outline.
- Structure.
- Origin. It *arises* by its superior head, along with the triceps, from the posterior part of the sacral spine, from the spines of some of the first



coccygeal bones, and from the sacro-sciatic ligament; by its inferior head from the spine of the ischium. Inferiorly its aponeurosis is confounded with that on the posterior tibial region, while the tendon glides on the inner aspect of the tibia, to be *inserted* on its anterior crest. Termination.

The superior prolongation of this muscle is covered by the gluteal fascia, and covers in turn the triceps and sacro-sciatic ligament. Beneath this the muscle responds externally to the triceps and gastrocnemius, internally to the semimembranosus and sartorius, anteriorly to the sciatic nerve, and posteriorly to the continuation of the gluteal aponeurosis. When its superior extremity is the fixed point, this muscle flexes the thigh, and renders tense the tibial aponeurosis; when the leg is fixed, it may assist in raising the body during rearing. Relations.

*Differences.*—In other domestic animals than solipedes and the pig, this muscle arises from the ischium only. In the latter animal, a very small band ascends to the sacrum. Ruminants, carnivora, and pig.

*Triceps abductor femoris*, (ischio-tibialis externus, Gir.; vastus longus, Rig.; biceps femoris, and part of the gluteus maximus in man).—(Fig. 176, Nos. 28, 29, 30; Fig. 193, Nos. 5, 5', 8.)—This is a long and very bulky muscle, occupying the whole external aspect of the thigh. It extends from the sacrum to the upper end of the tibia, and, like the semitendinosus, is curved with its convexity posteriorly. This muscle is thick and prismatic for about the upper two-thirds, but below this is flattened from side to side, and divided into three distinct heads—an anterior, median, and posterior. The *anterior head* (Fig. 193, No. 5) is broadest superiorly, and somewhat narrowed at its lower extremity; its fibres run from above downwards and forwards. Situation, outline, and direction.  
The *median head* (Fig. 176, No. 29; Fig. 193, No. 5') has its superior extremity narrow, and expands inferiorly; the fibres of this portion run more downwards, though still forwards, from a tendinous band extended along its posterior border. Each of these portions has, on the inner aspect of its inferior third, a strong tendinous membrane continuous superiorly with an aponeurosis. Anterior head.  
The *posterior portion* (Fig. 193, No. 8) is a small, slightly rounded muscular mass, the fibres of which run nearly straight downwards from an aponeurosis which separates this from the median head. Median head.  
The two posterior heads are inseparably united through the medium of this aponeurosis, except for five or six inches at their lower extremities. Posterior head.

This muscle has the following points of *origin*: 1st, From the spine Origin.

of the sacrum and aponeurosis of the coccygeal muscles, along with the semitendinosus and gluteus medius; 2nd, from the sacro-sciatic ligament; 3rd, from the tuberosity and spine of the ischium. The *anterior* or *larger head* is *inserted* by flattened tendon on the posterior aspect of the femur, between the two small trochanters, to the antero-external surface of the patella, and to the corresponding portion of its capsular ligament. The *median head* is *inserted* by aponeurosis which plays over the outer aspect of the tibia, upon the crest of that bone, and upon the fascia covering the gastrocnemius muscle. The aponeurosis terminating the *posterior head* goes exclusively to the fascia of the leg, through which it is continued to the tibial crest and os calcis.

**Relations.** Externally it responds by its superior extremity to the gluteal aponeurosis, and below this to the fascia lata, here augmented by a layer of yellow elastic tissue; from these aponeuroses many of its fleshy fibres originate. Internally it is related to the aponeurosis of the gluteus externus, the ischiatic tuberosity, to a deep fold of the fascia lata, by which it is separated from the vastus externus, to the internal aspect of the tibia, over which it glides by means of a synovial bursa, to the sciatic nerve, to the adductor magnus, semimembranosis, and by the posterior head to the semitendinosus. Its posterior border is related to the fascia and skin inferiorly, and to the semitendinosus superiorly, where its insertion is concealed by the latter muscle.

**Actions.** Those portions of this muscle which are inserted on the femur and patella abduct and extend the femur, while those inserted on the tibia and its aponeurosis simply flex the latter bone, and render tense the fascia of the leg. If the limb is fixed, it may assist the other muscles of this region in raising the body during the act of rearing.

**Ruminants.** *Differences.*—In *ruminants* this muscle is continuous above with the gluteus externus, of which the mass corresponding to the anterior head in the horse seems simply a continuation. These two represent the gluteus maximus of man, while the posterior portion homologates the biceps femoris. The anterior mass has its fibres directed from above downwards and forwards; the posterior is only distinguishable from it by the vertical direction of its fibres. The fascia lata unites with the anterior border of the muscle, and sends aponeurotic layers on both its internal and external aspects. It does not take any insertion on the femur, but simply on the patella, tibia, and tibial aponeurosis. It plays by means of a large synovial bursa over

Insertion of  
the anterior  
head;

of the me-  
dian;

and the  
posterior.

Anterior  
portion;  
posterior  
portion.

the trochanter major, and by a smaller over the outer condyle of the femur. The former bursa is frequently the seat of inflammation.

The same arrangement exists in the *pig*, only no bursa exists over the outer condyle.

In *carnivora* this muscle is composed of two distinct portions <sup>Dog.</sup> superiorly, which become amalgamated inferiorly. The anterior portion arises from the ischiatic tuberosity and sacro-sciatic ligament, the posterior from the former process only. They are inserted together on the internal lateral ligament of the patella and the tibial crest.

#### TIBIAL FASCIA.

The bones of the *leg* are enveloped on their anterior, posterior, and external aspects by muscle, so that the inner aspect only of the tibia holds a subcutaneous position. The whole of these muscles are enclosed in a common fascia, the *tibial aponeurosis*. This is composed of several superimposed folds, and at its superior border receives the insertion of the triceps abductor femoris, semitendinosus and gracilis; inferiorly, it is continuous over the tarsus and metatarsus, and in descending over the latter it decreases in thickness. At the tarsus it is intimately united to the annular ligaments which bind down the various tendons, and firmly inserted on the summit of the os calcis. It is attached internally to the internal aspect and crest of the tibia. This fascia is strengthened posteriorly by a strong fibrous band, which is intimately united to the tendon of the perforatus at its origin. It separates from this in descending, sends fibrous slips to the tendon of the gastrocnemius, afterwards divides into two portions, which occupy the depressions in front of the hamstring, and is finally inserted on the perforatus tendon and lateral aspects of the os calcis. The gastrocnemius tendon is accordingly completely surrounded, towards its insertion, by the tendon of the perforatus and this powerful band.

Tibial  
fascia.

Formed of  
various  
folds.  
Superior  
border.

Inferior border.

Internal borders.  
Adventitious band.

The tibial fascia is separated from the skin by a thin layer of areolar tissue. From its internal aspect it sends off numerous folds, which, insinuating themselves between the individual muscles, form special aponeurotic sheaths.

Relations of  
the tibial  
fascia.

#### ANTERIOR TIBIAL REGION.

This region contains three muscles, namely, the *extensor pedis*, *peroneus*, and *flector metatarsi*. The latter muscle is covered by the two former.

Number of  
muscles.



*Dissection.*--For the dissection of the muscles of the leg, whether posterior or anterior, the tibial aponeurosis must be removed, care being taken to preserve the strong posterior band with its various insertions. The skin should be raised from the metatarsal region, and the hoof removed in the same manner as recommended for the fore-extremity. The muscles may then be carefully isolated from each other, a process so simple as to require no special directions.

Situation.	<p><i>Extensor pedis</i>, (femoro-prephalangens, Gir.; extensor digitorum anterior, Rig.; extensor longus digitorum pedis in man).—(Fig. 176, No. 36; Fig. 193, No. 13.)—This is an elongated muscle, extended along the anterior aspect of the tibia, metatarsus, and phalanges. It is composed of a fleshy portion, terminated inferiorly by an elongated tendon. The <i>muscular portion</i> is fusiform, but slightly compressed from before backwards. It is covered by an aponeurosis, thickest in its superior half, and is intersected by several fibrous bands which unite towards the lower extremity of the muscle to form a median flattened tendon, upon which the muscular fibres take their insertion. A little above the lower fourth of the tibia, the muscular portion ends in a rounded tendon, which, becoming flattened, plays, by the aid of a synovial bursa, through three annular ligaments in front of the tarsus; it then descends on the anterior aspect of the metatarsus, receives the tarso-prephalangens and peroneus tendon, is intimately united to the capsular ligament of the metatarso-phalangean joint, and afterwards comports itself exactly like the tendon of the extensor pedis in the fore-limb.</p>
Muscular portion; its form and structure.	
Extent, course, and relations of the tendon.	
Origin.	The flexor pedis arises by a strong tendon common to it and the flexor metatarsi, from a fossa between the trochlea and external condyle of the femur, and is <i>inserted</i> by its flattened tendon on the anterior aspect of the two first phalanges and the pyramidal eminence of the os pedis, with the fossæ on each side of its base.
Insertion.	
Relations.	<p>The muscle responds in front to the tibial fascia and aponeurosis of the triceps abductor femoris; behind to the flexor metatarsi, and postero-externally to the peroneus. The tendon covers successively the anterior aspect of the tibia, the anterior common ligament of the tarsus, the tarso-prephalangens, the front of the large metatarsal bone, fetlock-joint, two first phalanges, and the inter-phalangean articulations. It is covered in turn by the tibial fascia, and by three annular ligaments in front of the tarsus; the superior extends from the lateral aspects of the lower end of the tibia, and includes the flexor metatarsi tendon as well; the median extends from the middle division of the flexor metatarsi tendon to the lower extremity of the</p>
Annular ligament in front of the tarsus.	

os calcis, repeating more superficially the internal division of the latter tendon, and inclosing the extensor pedis tendon only; the inferior extends across the head of the large metatarsal bone, from one side to the other, and binds down the tendon and that of the peroneus. Beneath this the tendon is enveloped in condensed areolar tissue. The bursa possessed by this tendon, in front of the tarsus, extends to the middle of the cannon. Another large bursa exists between this tendon and the capsular ligament of the fetlock.

This muscle extends the phalanges individually, and the whole digital region on the metatarsus. Action.

*Differences.*—In *ruminants* this muscle is represented by two fleshy bellies, confounded with each other and with that of the flexor metatarsi in the superior third, but quite distinct in their lower two-thirds. The three muscles referred to *originate* by a common tendon from the fossa, between the trochlea and external condyle of the femur. That which truly corresponds to the extensor pedis is placed on the outer aspect of the flexor metatarsi, and ends in a tendon which, extending down in front of the tarsus and metatarsus, becomes bifurcated in the lower third of the latter region, and sends a tendon to each claw, which repeat precisely the arrangement already described in the similar muscle of the fore-limb. The second portion, the *extensor proprius digitis interni*, has its muscular body hidden under that of the last. Its terminal tendon divides into two, which, as in the corresponding muscle of the fore-limb, go to the internal digit, to be *inserted* respectively on the anterior aspect of the second, and internal surface of the third phalanges. Has two heads in the ox.  
Origin.  
Insertion.  
Insertion of the additional head.

In the *pig* the same arrangement is repeated, with these modifications, that the *common extensor* has four tendons, one for each digit, while the other belly has two, going to the two internal digits. Fig.

In *carnivora*, the *common extensor* (extensor longus digitorum pedis) is a fusiform muscle, terminated by a flattened tendon, which soon divides into four—one for each of the larger digits. The fleshy body, which is fusiform, *originates* by strong tendons from the lower end of the femur, between the trochlea and condyle. It extends along the external aspect of the tibia, outside the tibialis anticus, and ends in a tendon which runs beneath an annular ligament on the lower end of the tibia, and another on the anterior aspect of the tarsus. Dividing into four, this tendon becomes *inserted* on the phalanges of the four outermost digits, as in the corresponding muscle in the fore-limb. Dog.  
Origin.  
Insertion.

Situation and form.	<p><i>Peroneus</i>, (peroneo-prephalangeus, Gir.; extensor digitorum lateralis, Rigot; peroneus brevis in man).—(Fig. 176, No. 35; Fig. 193, No. 12.)</p>
Structure.	<p>—Placed between the last muscle and the flexor pedis perforans, and extended along the <i>external</i> aspect of the fibula and tibia, the peroneus is a long prismatic muscle, extended to the middle of the metatarsus by a small tendon. The muscular portion, which follows the course of the fibula, has its fibres converging from above downwards,</p>
Tendon—its course.	<p>to be inserted on the tendon. The tendon, which commences close above the external malleolus, passes through the groove in that tuberosity, inclines forwards on the external aspect of the tarsus, where it plays through a strong fibrous sheath, partly formed by the external lateral ligament, and runs beneath the annular ligament on the head of the metatarsal bone, along with the tendon of the extensor pedis, which it joins about the middle of the metatarsal region.</p>
Origin.	<p>This muscle <i>arises</i> by its fleshy body from the external lateral ligament of the stifle, from the head and whole external aspect of the fibula, from a strong aponeurosis separating this muscle from the flexor perforans, and from the superior portion of a powerful aponeurotic band, extending from the external border of the fibula to the malleolus externus, and continuous by its outer border with the tibial fascia. It joins the tendon of the extensor pedis in the metatarsal region, though it may not be completely amalgamated with it before reaching the level of the fetlock-joint.</p>
Termination.	<p>The peroneus is covered externally by the tibial fascia, which, with the dense aponeurotic bands on its anterior and posterior aspects, form a strong special sheath in which the muscle is enveloped. By this it is divided anteriorly from the extensor pedis, and posteriorly from the flexor perforans. The tendon is enveloped in the various structures already mentioned, and by a synovial bursa which facilitates its movements through the same.</p>
Relations.	<p>The action of this is exactly similar to that of the last muscle.</p>
Action.	<p><i>Differences</i>.—In <i>ruminants</i> this muscle is represented by the <i>extensor of the external digit</i>, which arises from the head and outer border of the fibula, descends on the corresponding aspect of the tibia, where, both in position and form, it resembles that of the peroneus in the horse, and terminates, by a long tendon, on the outer aspect of the external distal phalanx.</p>
Fig.	<p>In the <i>pig</i> the terminal tendon of this muscle is bifurcated, and goes to the outer distal phalanges.</p>
Dog.	<p>In <i>carnivora</i> it is divided into a superior and an inferior portion.</p>



The *superior portion* is composed of a small muscular belly, *originating* from the anterior border of the fibula in its superior third, and terminating on a level with the middle of the tibia in a correspondingly small rounded tendon. This passes with the tendon of the peroneus longus over the lower end of the fibula, passes forwards beneath the tendon last named, and, gaining the anterior aspect of the outer digit, becomes *attached* to the corresponding branch of the common extensor tendon. The *inferior portion arises* from the anterior border and external aspect of the fibula, and ends in a tendon shorter but bulkier than that of the last. This passes over the lower end of the fibula, and over the tendon of the anterior portion, to be *inserted* on the head of the external metacarpal bone, outside the insertion of the peroneus longus. The former extends the external digit, the latter abducts the foot.

Superior head.

Inferior head.

*Flexor metatarsi*, (tibio-premetatarsus, Gir.)—(Fig. 194, No. 13.)

—Situated on the external aspect of the tibia, beneath the extensor pedis, the flexor metatarsi is a large elongated muscle, somewhat flattened towards its superior extremity, and composed of an anterior tendinous and a posterior muscular portion. These divisions are quite distinct for some distance from their respective origins and insertions, but are intimately attached to each other in their median two-thirds, and at their common insertion.

Situation, form, and structure.

The tendon (*peroneus tertius* of man), which is long and cylindroid, *arises* from the fossa between the trochlea and external condyle of the femur, and passes downwards in the notch on the head of the tibia which separates the anterior from the external tuberosity; an extension of the synovial membrane of the femoro-tibial articulation facilitates its gliding through this notch. Beneath this its anterior aspect gives origin to the muscular fibres of the extensor pedis, and still lower its posterior surface receives the insertion of numerous fibres of the muscular portion, and detaches several tendinous bands, which plunge into the substance of the latter. At the lower end of the tibia, it passes beneath an annular ligament with the tendon of the extensor pedis, and in front of the trochlea of the astragalus, divides into two branches. Of these, one strong and flattened is *inserted* in front of the large metacarpal bone at its superior extremity; the second is subdivided into two portions, which become *inserted* together on the external aspect of the cuboid, and between which passes the tendon of the extensor pedis. The latter has a synovial bursa, by which it glides over the outer aspect of the cuboid.

Tendon—its origin and course.

Its connection with the extensor pedis and flexor metatarsi.

Insertions of the tendon.

Outline of the muscular portion.	The <i>muscular portion</i> (tibialis anticus of man) is situated between the tendon and the external aspect of the tibia, and is elongated in the same direction as the former. It is broad and flattened superiorly, but approaches the conical form towards its inferior extremity, where it terminates in a thick powerful tendon. It <i>arises</i> from the tibia on each side of the notch through which the tendon passes, from the external aspect of the same bone for some distance below its superior extremity, from the adjacent portion of the aponeurosis separating this muscle from the peroneus, and from the tendinous portion, by means of the fibrous bands it receives from the latter. Its inferior tendon is very short, and in front of the astragaloid trochlea, divides into a median and an internal division. The former, which is much the stronger, joins the corresponding branch of the tendinous portion, with which it is <i>inserted</i> on the anterior aspect of the large metatarsal bone; the latter turns inwards and downwards to gain the cuneiform medium, upon which it takes <i>insertion</i> .
Origin.	
Tendon of insertion.	
Insertions.	
Relations.	The flexor metatarsi responds anteriorly to the extensor pedis, and posteriorly to the external aspect of the tibia and the aponeurotic sheath of the peroneus. On reaching the hock, the combined tendons pass under the annular ligament on the lower end of the tibia, and above the anterior common tarsal ligament.
Uses of the tendon.	By virtue of its origin in front of the femoral condyle, the tendinous portion acts mechanically in flexing the tarsus whenever a similar movement of the stifle is effected. For the same reason, if the hock is powerfully extended, the stifle cannot be brought into the condition of flexion. The muscular fibres inserted on the tendon assist in its flexion of the tarsus. The muscular portion is a simple flexor of the metatarsus.
Action of the muscle.	
Ruminants. Origin.	<i>Differences.</i> —In <i>ruminants</i> the <i>flexor metatarsi</i> arises from the lower end of the femur by a tendon common also to the <i>common</i> and <i>internal extensors</i> of the digits. Below this it is composed of a fleshy belly covering those of the two muscles referred to, and terminated inferiorly by a tendon, which is inserted on the anterior aspect of the cuneiform and superior extremity of the large metatarsal bone. Its action is simply to flex the metatarsus on the leg.
Insertion.	
Action.	
Two heads in the pig.	In the <i>pig</i> the flexor metatarsi is represented by two muscular bellies. That corresponding to the tendinous portion in the horse arises from the superior extremity of the tibia and lower end of the femur, along with the <i>common</i> extensor of the digits, and is prolonged by its inferior tendon to the scaphoid and cuneiform medium.

The deep belly, which represents the muscular portion in the horse, *arises* from the internal aspect of the tibia, and is *inserted* on the cuneiform medium.

In *carnivora* this muscle is larger than the common extensor of Dog and cat. the digits in front of which it is situated. It *arises* from the crest Origin. and external tuberosity of the tibia where it covers the superior extremity of the common extensor, and descends as a single fleshy belly along the outer aspect of the tibia, in the lower third of which it receives a very delicate muscular band from the fibula, (extensor proprius pollicis in man). Its terminal tendon, after playing through an annular ligament in front of the tarsus, divides into two branches, Tendon bifid. which, running inwards and downwards, become *inserted* respectively Insertion. inside the upper extremity of the internal metacarpal bone, and on the distal phalanx of the corresponding digit. Its annular ligament, which is inserted on the lateral aspects of the lower end of the tibia, gives origin, by its external extremity, to a strong fibrous band Complimentary fibrous structure; which passes under the flexor metatarsi tendon, contracts intimate attachments to the anterior common ligament of the carpus, and is inserted on the superior extremity of the third metatarsal bone. This ligament preserves the hock in a semiflexed position, and thus fulfils its use. the functions of the tendinous portion of the muscle in the horse.

#### ADDITIONAL MUSCLES OF THE ANTERIOR TIBIAL REGION IN RUMINANTS, PIGS, AND CARNIVORA.

*Ruminants.*—In these animals a *peroneus longus* exists. *Arising* Peroneus longus. at the head of the tibia from the anterior aspect of its external tuberosity, it descends on the external surface of the same bone, between the peroneus brevis, and the flexor metatarsi and extensor pedis. It is formed of a short conoid muscular belly, terminating inferiorly in a tendon. The tendon passes under the same annular ligament as the peroneus brevis, where it is provided with a special synovial membrane. It afterwards crosses over the latter tendon, turns backwards and inwards, passing under the external lateral tarsal, calcaneo-metatarsal, and posterior common ligament of the tarsus, plays through a groove on the inferior aspect of the cuboido-scaphoid, and is *inserted* Insertion. on the lower aspect of the cuneiform medium, and outside the upper end of the large metatarsal bone.

*Pig.*—This animal has likewise a peroneus longus, the terminal Pig. tendon of which is *inserted* on the head of the external metatarsal bone.



Dog and cat.  
Origin of the  
peroneus  
longus.  
Outline.

Tendon; its  
course and  
insertions.

Relations.

Use.

In *carnivora* this muscle arises from the anterior aspect of the external tuberosity of the tibia, is extended down the external surface of the tibia, at first as a short conical muscular body, afterwards as a long rounded tendon. The latter crosses over the lower end of the fibula, and, on reaching the cnoid, glides through a canal on its external surface, sends a bundle to the superior extremity of the external metatarsal bone, and another to the interosseous muscle between the two outer metatarsals; the tendon then runs across the posterior aspect of the lower range, and is inserted on the upper end of the internal metatarsal bone. This muscle responds posteriorly to the peroneus brevis, anteriorly to the common extensor of the digits, externally to the tibial aponeurosis, and internally to the anterior tibial blood-vessels. It serves to abduct the limb and to flex the foot, when that has been fully extended.

#### POSTERIOR TIBIAL REGION.

Six posterior tibial muscles.

This region contains six muscles, the *gastrocnemius*, *soleus*, *flexor pedis perforatus*, *flexor pedis perforans*, *flexor pedis accessorius* and *popliteus*. The three former constitute a superficial, and the three latter a deep layer.

Situation.

Two heads—their form and connections.

Structure.

Form and course of the tendon.

Origin of

*Gastrocnemius*, (bifemoro-calcaneus, Gir.; gemini tibialis, Rig.; gastrocnemius externus, Per.)—(Fig. 176, No. 33; Figs. 192 and 194, No. 9.) —This muscle is situated superficially on the posterior aspect of the leg, between the aponeuroses of the semitendinoses and the triceps abductor femoris. It is formed of two muscular masses, distinct from each other at their origins only, and continuous inferiorly with a flattened tendon. Each lateral portion is somewhat flattened from side to side, and thickest at its median part, from which it diminishes towards either extremity. They are continuous with each other in the median line, so that they present a smooth convex posterior aspect, while their anterior surface is hollowed out into a large groove, into which are received the flexores pedis perforans and perforatus, together with the condyles of the femur. The two bellies are covered by glistening aponeuroses, to which their fibres are attached, and are intersected by several tendinous bands. The tendon is fasciculated as it emerges from the compound muscular belly, but soon becomes rounded, receives the tendon of the soleus, also a fibrous bundle from a strong aponeurotic band extending along the front of the perforatus, and turns round the external aspect of the tendon of the last-named muscle, to gain its anterior surface before taking its insertion.

The two heads take their *origin* above their respective condyles of

the femur, the *external* (Fig. 194, No. 9) from the outer margin of the supra-condyloid fossa, and the *internal* (Fig. 193, No. 9) from the supra-condyloid cleft. The terminal tendon becomes *inserted* on the posterior portion of the upper end of the os calcis, the anterior portion of the same eminence being covered by cartilage of encrustation, and provided with a synovial membrane to facilitate the gliding of the tendon during extreme flexion.

This muscle responds posteriorly to the semimembranosis, semiten-  
dinosus, and triceps abductor femoris, also to the tibial fascia; ante-  
riorly to the perforatus, to which it is firmly adherent, to the vastus  
externus, the popliteus muscle, to the vessels of the same name which  
pass between its two heads, to the sciatic nerve, to the flexor per-  
forans and flexor pedis accessorius. The tendon lies successively on  
the posterior, external, and anterior aspects of that of the perforatus,  
the two representing the *tendo Achilles* in man.

The gastrocnemius extends the metatarsus upon the tibia, propelling  
the body forwards during progression. It also preserves the pro-  
per size of the angle between the tibia and metatarsus while the  
animal is standing.

*Soleus*, (plantaris, Bourg., Per., &c.; peroneo-calcaneus, Gir.)—  
Placed on the postero-external aspect of the leg, between the tibial  
fascia on the one side, and the perforans and outer head of the gas-  
trocnemius on the other, the soleus is an extremely thin, narrow, but  
elongated muscular band terminated inferiorly by a tendon. *Arising*  
from the posterior aspect of the head of the tibia between the flexor  
pedis and flexor pedis accessorius, its tendon joins that of the gas-  
trocnemius, with which it is continued to the os calcis. Its action is  
similar to that of the last-named muscle.

*Differences*.—*Carnivora* possess no such muscle.

*Flexor pedis perforatus*, (femoro-phalangeus, Gir.; gastrocnemius  
internus, Per.; plantaris and flexor brevis digitorum of man).—The  
perforatus is placed on the posterior aspect of the leg, between the  
bellies of the gastrocnemius, and extended down the metatarsal and  
digital regions as far as the second phalanx. It is represented by a  
strong fibrous cord which bulges slightly, and becomes somewhat  
muscular in its superior fifth. Taking its *origin* from the supra-con-  
dyloid fossa, the fusiform fleshy belly, which is thickly intermingled  
with tendinous fibres, runs downwards and backwards between the  
deep layer of posterior tibial muscles and the bellies of the gastroc-  
nemii, to the external of which it is intimately attached. Immedi-  
ately below the upper third of the tibia it ends in a rounded tendon,

the outer  
and inner  
heads.

Insertion.

Relations.

Tendo  
Achilles.

Action.

Position  
and form.

Origin.

Termina-  
tion.

Is absent in  
the dog.

Position.

Structure.

Origin and  
direction.

which, proceeding in the same direction, turns round the internal aspect of the gastrocnemius tendon to gain its posterior surface, and above the os calcis unites with a powerful aponeurotic band described with the tibial fascia. Over the point of the hock it is flattened out so as to form a cap for that process, on the lateral aspects of which it is firmly *attached*, while it plays over its median part by the aid of a large synovial bursa. Beneath the hock it remains somewhat flattened, lies along the posterior surface of the perforans tendon, and comports itself exactly as in the corresponding region of the forelimb, becoming ultimately *inserted* by a bifurcated tendon on the supero-lateral angles of the posterior surface of the os coronæ.

Connection  
with the  
os calcis.

Insertion.

Action.

The perforatus tends to extend the metatarsus and flex the digital region. Its principal use, however, is while the animal is standing, when it prevents abnormal extension of the fetlock, and undue flexion of the hock. These it performs mechanically, so long as the femur is kept extended on the tibia by the triceps cruris.

In ox and  
pig is less  
tendinous.

Very mus-  
cular in the  
dog and cat.

*Differences.*—In *ruminants* and *pigs* the muscular belly of this muscle is relatively larger than in solipedes. In the *pig* it is inserted on the second phalanges of the two larger digits only. In *carnivora* it has a large prismatic muscular body, confounded in its superior two-thirds with that of the gastrocnemius externus. Its large tendon, after passing over the os calcis, divides into four, to become inserted on the second phalanges of the four external digits. Some delicate muscular bundles, extended along the divisions of the tendon, and inserted into them, seem to homologate the flexor brevis digitorum in man.

Situation.

Direction,  
form, and  
structure.

Origin.

*Flexor pedis perforans*, (tibio-phalangeus, Gir.; flexor perforans, and flexor longus pollicis pedis in man).—(Fig. 194, No. 12.)—Situated deeply on the posterior aspect of the leg and foot, this muscle is composed of a superior muscular belly, terminated inferiorly by an elongated tendon. The muscular portion, which extends downwards and inwards along nearly the whole length of the tibia, is thick and bulky at its median part, from which it diminishes gradually towards either extremity. It is covered by a glistening aponeurosis, intersected by powerful tendinous bands, and imperfectly divided into two portions, an internal and an external, of which the former is much the smaller; the former represents the flexor of the great toe in man, the latter the perforans. It *arises* from the external tuberosity on the head of the tibia—from the posterior rugose surface outside the insertion of the popliteus, and extending nearly to the lower third of the



bone; from the posterior aspect of the fibula, and the interosseous ligament binding it to the other bone of the leg. A short distance above the hock, the muscular belly ends in a rounded tendon, which is at first double, its two portions seeming to correspond to the divisions of the muscular part. The common tendon resulting from the union of these divisions, plays over the groove on the inner aspect of the os calcis, where it is bound down by a strong annular ligament, and provided with a large synovial membrane, extending upwards on the posterior tibio-tarsal ligament, and downwards to between the upper and middle thirds of the metatarsus. Running down the posterior aspect of the metatarsus, between the perforatus tendon and suspensory ligament, it receives a strong fibrous band (metatarsal ligament) from the origin of the latter, and afterwards comporting itself precisely like the perforans of the fore-limb, it pierces the ring of the perforatus, and is ultimately *inserted* on the semilunar ridge of the os pedis. The metatarsal ligament is much smaller than its homologue on the fore-limb.

Tendon: its form and course.

Metatarsal ligament.

Insertion.

The muscular portion of the perforans responds externally to the extensor suffraginis, solens, and tibial aponeurosis; internally to the popliteus, the flexor pedis accessorius, and the same aponeurosis; posteriorly to the gastrocnemius, perforatus, and the fibrous band extending along the anterior surface of the latter. The tendon is enveloped by the tarsal arch, on the inner side of the os calcis, after which it comports itself exactly as in the fore-limb.

Relations.

This muscle flexes the phalanges on the metatarsus and on each other. When the foot is fixed on the ground, it extends the metatarsus on the tibia, thereby assisting in progression. Moreover, the metatarsal ligament inserted into it enables it to act as a mechanical support while the animal is standing.

Action.

*Differences.*—In *ruminants* the two portions of which this muscle is composed are more distinct from each other than in solipedes. The internal is lodged in a groove on the inner aspect of the other. The common tendon, after playing over the groove inside the os calcis, repeats in its relations and attachments its representative in the fore-limb, with this exception, that the ligament it receives from the superior extremity of the metatarsus is much smaller. In the *pig* its tendon divides into four branches, one for each digit.

Ruminants.

Pig.

In *carnivora* the muscles representing the *perforans* and *flexor longus pollicis* are quite distinct. The former *originates* like as in the horse, descends through the tarsal arch, and divides into five tendinous

Carnivora.  
Perforans.

**Flexor longus pollicis.** branches, which are *inserted* on the five digits. The *latter* is represented by a delicate muscular belly, situated between the preceding muscle and the flexor pedis accessorius. It *arises* from the head of the fibula and the posterior aspect of the tibia, and terminates in a long delicate tendon, which, after playing through a groove on the posterior aspect of the external malleolus, turns inwards to be *inserted* on the posterior tarso-metatarsal ligament, towards its median part.

*Flexor pedis accessorius*, (peroneo-phalangeus, Gir.; flexor digitis obliquus, Rigot; tibialis posticus in man).—(Fig. 194, No. 11.)—  
**Position and direction.** Situated on the posterior aspect of the tibia, above the popliteus and perforans, the flexor pedis accessorius partly crosses the leg in a downward and inward direction. It is composed of a muscular and a tendinous portion, the former of which is long, fusiform, and intersected by numerous fibrous bands, the latter, which commences in the lower third of the tibia, is round and elongated. This muscle *arises* from head of the tibia behind its external tuberosity, and, in the upper third of the metatarsus, its tendon becomes confounded with that of the perforans, after having played through a fibrous sheath inside the hock-joint.

**Form and structure.**  
**Origin.**  
**Termination.**  
**Relations.** The muscular belly responds anteriorly to the popliteus, the perforans, and the posterior tibial artery, posteriorly to the gastrocnemius, perforatus, and tibial fascia. The tendon is comprised at first between the muscular body of the perforans and the tibial fascia, afterwards it is enveloped in a tortuous fibrous sheath, which, from a groove on the internal malleolus, extends down the inner aspect of the tarsus.

**Action.** The action of this muscle is similar to that of the perforans.

*Popliteus*, (abductor tibialis, Bourgelat; femoro-tibialis obliquus, Gir.)—(Fig. 194, No. 10.)—Placed behind the tibia and femoro-tibial articulation, the popliteus is a short, flattened, triangular muscle, becoming tendinous at its supero-external angle. From this angle the muscular fibres radiate from above downwards and inwards, so that those towards the lower border are the longest. It *arises* from the lower of the two depressions on the outer aspect of the external condyle of the femur, to gain which its tendon passes under the corresponding lateral ligament. The lower extremity of its muscular fibres are *inserted* on the supero-internal, rugose, triangular surface, on the posterior aspect of the tibia.

**Position, form, and structure.**  
**Origin.**  
**Insertion.**  
**Relations.** This muscle responds posteriorly to the gastrocnemius, and perforatus muscles, and sciatic nerve; anteriorly to the capsular ligament of the stifle, the popliteal vessels, and the posterior aspect of the tibia;

externally it is related to the perforans and flexor pedis accessorius, and internally to the semitendinosus and fascia of the leg. Its tendon, which is covered by the external lateral ligament of the stifle, glides over the outer condyle of the femur, the border of the external semilunar cartilage, and the posterior portion of the external articular facet on the head of the tibia. It is covered, on its internal and part of its external aspect, by the external synovial membrane of the femoro-tibial articulation.

The popliteus flexes the tibia on the femur. It tends slightly, Action. moreover, to rotate the former inwards.

#### MUSCLES OF THE POSTERIOR FOOT.

*Solipedes*.—In these animals we find *two lumbrici* and *two interosseous* muscles, corresponding in every respect to those of the same name in the fore-limbs. Lumbrici and interossei.

There is, however, an additional muscle, the *calcaneo-prephalangeus* Calcaneo-prephalangeus. (*tarso-prephalangeus* of Girard), a delicate, flattened muscle, situated on the antero-external aspect of the large metatarsal bone, between the tendons of the peroneus and extensor pedis. It *arises* from the Origin. lower extremity of the os calcis, and is *inserted* on the posterior Insertion. aspect of the common extensor tendon, with which it concurs in extending the digital region.

*Ruminants*.—In these animals the *calcaneo-prephalangeus* is the only muscle of the foot. Taking its *origin*, like that of the horse, it is inserted on the tendon of the common extensor of the digits, and on that of the extensor of the internal digit. Ruminants have only one muscle of the foot.

*Pig*.—This creature has four *interosseous metatarsal muscles*, Pig. Four interossei. which differ in no essential particular from those of the fore-limb. It has likewise a *calcaneo-prephalangeus*, the two tendons of which are inserted on the two larger digits, with the corresponding tendinous branches of the common extensor. Calcaneo-prephalangeus.

*Carnivora*.—In the *dog* and *cat* are found *three lumbrici* and *four interosseous metacarpal muscles*, which closely resemble those of the same name in the fore-limbs. The following are peculiar to the hind foot. Dog and cat. Three lumbrici and four interossei.

A *calcaneo-prephalangeus*, having three muscular bodies which arise from the lower end of the os calcis and annular ligaments in front of the hook, and are united by their respective tendons to those branches of the common extensor that go to the second, third, and fourth digits. Calcaneo-prephalangeus.



**Perforatus.** The muscular belly of the *flexor perforatus* of man is represented by some sparse muscular fibres extended along the perforatus tendon.

**Flexor pedis accessorius.** A *flexor pedis accessorius muscle* arises from the posterior aspect of the hock-joint, descends as a delicate muscular band, and is inserted on the posterior surface of the perforans tendon by a correspondingly fine aponeurosis.

**Muscle of the inner digit.** The *adductor*, *abductor*, and *short flexor of the great toe*, are represented by some very pale and delicate muscular fibres, found on the palmar aspect of the metatarsus towards its inner border.

**Abductor minimi digiti.** The *abductor minimi digiti* is a small muscle, extended along the postero-external part of the metatarsus, from its *origin* on the posterior tarso-metatarsal ligament to its *insertion* on the internal aspect of the first phalanx of the outer digit.

## MYOLOGY OF BIRDS.

**Muscles and tendons in birds.** IN birds the individual muscles are composed of bright red and very compact fasciculi, with little areolar tissue intermixed. As a rule, the line of demarcation between a muscle and its tendon is much more distinct than in mammals, chiefly from the floridity of the form and the brilliant whiteness of the latter, the effect of which is enhanced by the non-tendinous structure of the muscular bellies.

**Osseous tendons.** The tendons present a special liability to undergo ossification, not as a result of disease or old age, but as a constant normal occurrence even in young animals. This deposition of osseous matter in the substance of the tendons is nearly invariable in the lower extremities, but is not necessarily confined to those. Other parts of the body will occasionally present a similar condition, especially noticeable in the necks of waders.

**Muscles of the trunk.** On the trunk of the bird we find homologues of nearly all the muscles found in the same regions in mammals. Their development is largely modified, however, according to the requirements of the part. Thus the muscles of the immoveable back are very slightly developed, while those of the mobile and elongated neck are large and active.

**Semispinalis dorsi.** The *semispinalis dorsi* is well marked, arising from the anterior border of the ilium and the transverse processes of the sacrum, extending forwards between the transverse and spinous processes, and becoming inserted by small tendons on the transverse processes

of the dorsal vertebræ. The *spinalis dorsi*, partly covered by the latter, extends from the anterior border of one dorsal spinous process to the posterior border of that immediately in front. The *cervicalis ascendens*, placed on the cervical and anterior portion of the dorsal region, arises from several of the anterior dorsal spines, and is inserted by small tendons on the atlas and the articular processes of the second, third, and fourth cervical vertebræ. It is also connected by muscular slips with the spines of the fifth and sixth cervical vertebræ. This is the chief extensor of the neck. The *semispinalis colli*, continuous behind with the *semispinalis dorsi*, extends from the transverse to the spinous processes in the cervical region. Outside the latter are the *intertransversales*, extending from the articular processes of the anterior dorsal to those of the posterior cervical vertebræ. Extended along the anterior aspect of the spine is the *longus colli*. This muscle arises from the anterior spines and anterior aspects of the bodies of the cervical vertebræ, and comporting itself somewhat as in mammals, is inserted on the transverse processes of the latter. A dependence of this muscle passes from the transverse processes of the first five cervical vertebræ to the inferior spines of those immediately in front. The *biventer cervicis*, formed of two muscular bellies, separated by an elongated median tendon, arises from the spinous processes of some of the lowest cervical vertebræ, and is inserted into the lateral aspect of the occiput. The *complexus*, placed outside, and crossing the upper belly of the last muscle, arises from some of the superior cervical transverse processes, and is inserted on the occipital bone. The *trachelo-mastoideus* originates from the articular processes of the second and four succeeding cervical vertebræ, and is inserted on the basilar process of the occiput. The *rectus capitis anticus major*, originating from the bodies of the sixth, seventh, and eighth cervical vertebræ, is inserted along with the last muscle. The *rectus capitis anticus minor* is likewise represented by a small slip. Small bundles represent the *large and small posterior recti*, and the superior oblique muscles of the head.

The tail is raised and its feathers spread out by the following muscles: *levator coccygis*, extending from the transverse process of the sacrum to the coccygeal spines and base of the last vertebra of the tail; strong *interspinales* muscles, occupying the intervals between the coccygeal spines; the *quadratus coccygis*, extending from the transverse processes of the sacral vertebræ to the shafts of the large tail quills; the *pubio coccygeus*, extending from the posterior extremity

of the pubis to the outer large quills; and the *ilio-coccygeus*, extending from the posterior border of the ilium to the last vertebral segment and the quills of the small inferior feathers. The tail is depressed by the following: *ischio-coccygeus*, which arises from the ischiatic tuberosity and the transverse processes of the first coccygeal vertebrae, and is inserted on the inferior spines of the last coccygeal vertebrae and the lateral aspect of the last segment; and the *depressor coccygis*, which arises from the ventral aspect of the first coccygeal vertebrae, and is inserted on the inferior spines of several of the posterior segments.

Muscles of  
the ribs.

The ribs are possessed of three sets of muscles, the *levator costarum*, the *intercostales externi*, and the *intercostales interni*. The first set present a similar arrangement with those of mammals. Those belonging to the two first ribs are largely developed, and originate from the transverse processes of the two last cervical vertebrae, so that they homologate pretty closely the *scaleni* of mammals. The *external intercostals* are divided into portions, the anterior of which arises from the costal appendage, a circumstance that enables it to act with greater power upon the next succeeding rib. The *internal intercostals*, which proceed as in other animals, from behind downwards and forwards, do not extend higher than the costal appendages.

Abdominal  
muscles.  
External  
oblique.

The *abdominal muscles* are small and weak. The *external oblique* arises from the inferior ribs by short digitations, and from the superior ribs and the lateral parts of the ilium and pubis by aponeurosis. It is inserted on the lower border of the pubis and the linea alba, where it meets its fellow. This muscle draws back the sternum and sternal ribs, and thus enlarging the angle between the latter and the costal ribs, expands the thorax and assists in inspiration. The *internal oblique* arises from the whole lower border of the pubis, from its anterior half by muscular, and from its posterior half by aponeurotic tissue, and extends forwards to the last rib, upon which it is inserted. It compasses the abdomen. The *transversalis*, which has a similar action to that of the last muscle, arises from the whole anterior border of the pubis, and the outer aspects of the three last ribs; it joins its fellow at the linea alba. The *rectus abdominis* arises from the lower and posterior half of the pubis by thin tendon, becomes muscular about the middle of the abdomen, and is ultimately inserted on the posterior border of the sternum. This muscle, which acts like the external oblique, as an inspiratory muscle, is remarkable for being

Internal  
oblique.

Transver-  
salis.

Rectus.



destitute of tendinous intersections in the bird. The *diaphragm* ex- Diaphragm.  
tends from the sternal ribs on the one side to those on the opposite,  
and thus confine the lungs to the posterior part of the thorax. The  
digitations by which it is attached to the ribs are delicate muscular  
fascioli, extending a very short distance on the central median ten-  
don, so that they do not even unite to each other laterally. By its  
contraction it serves to dilate the lungs, though its efficiency in this  
respect is hindered by the openings into the numerous aerial cavities.  
A second membrane, extending from the dorsal vertebræ to the ster-  
num, and imperfectly separating the thorax from the abdomen, has  
been described by Sappey as a second diaphragm. This structure,  
which is supposed to represent the pillars of the diaphragm, is convex  
anteriorly, concave posteriorly, and assists in filling the aerial cavities  
in front of it during inspiration.\*

Among the muscles of the *wing*, the pectorals are remarkable for Wing  
their size and peculiarity of arrangement. The *pectoralis magnus*, muscles.  
generally the largest muscle in the body, arises from the outer aspect Pectoralis  
of the furculum, the lateral aspect of the keel of the sternum, and magnus.  
the postero-external part of the lower surface of the same bone.  
It is inserted on the crest outside the body of the humerus by a broad  
flattened tendon. It depresses the latter bone actively in flight. The  
*pectoralis parvus* is a large muscle, flattened posteriorly, bulky in its Pectoralis  
median part, and terminated anteriorly by a tendon. It arises from parvus.  
the base of the keel and lower aspect of the sternum, and is inserted  
on the crest of the humerus. Before its insertion, the tendon passes  
through a foramen formed by the three shoulder-bones, and assumes  
a backward in place of a forward direction. By this admirable  
arrangement, two important purposes are served; the bulky muscle,  
from its position on the inferior and median aspect of the body, serves  
as ballast in preserving the equilibrium during flight, while the acute  
bend given to the tendon enables it to elevate the humerus and wing  
quite as well as if the muscle had been placed in the dorsal region.  
A *third pectoral muscle*, much smaller than the other, extends Additional  
from the antero-external part of the lower aspect of the sternum, pectoral.  
and from the outer surface of the lower half of the coracoid bone,  
to be inserted by strong tendon on the internal tuberosity of the  
humerus, which it depresses. The *trapezius* is a flat, thin muscle, Trapezius,  
originating from the two or three last cervical and a corresponding

\* SAPPEY, *Traité d'Anatomie Descriptive*, 1857, tom. i. p. 197.

Rhomboideus.	number of the first dorsal spines, and becoming inserted on the dorsal border of the scapula and scapular end of the clavicle. The <i>rhomboides</i> , a single but large and powerful muscle, extends from all the dorsal spines to the superior border of the scapula. The <i>levator scapulæ</i> arises by digitations from the last cervical transverse process and the first two ribs, and is inserted on the posterior part of the dorsal edge of the scapula, which it raises and draws forwards. The <i>latissimus dorsi</i> is in two portions, which originate from several of the first and last dorsal spines, and are inserted by separate tendons on the supero-external aspect of the humerus. The <i>serratus magnus</i> is in two portions: an anterior, extending from the lower extremities of the first two ribs to the inferior border of the scapulo; a posterior, thinner, broader, and paler than the anterior, arising from three or four of the middle ribs, and inserted on the venter scapulæ towards its posterior extremity. The <i>supra-spinatus</i> , a small muscle, strengthened internally by a powerful ligament, extends from the lower part of the dorsum scapulæ to the internal tuberosity of the humerus. The <i>infra-spinatus</i> , which is larger, arises from the greater part of the dorsum scapulæ and the lower border of the same bone; it is inserted on the internal tuberosity of the humerus. The <i>subscapularis</i> extends from the lower part of the venter scapulæ to the same tuberosity. The <i>deltoides</i> is a considerable muscle, extending from the outer aspect of the scapula towards its lower extremity, along the inner aspect of the shoulder-joint to the middle of the outer surface of the humerus. It flexes the latter bone. The <i>coraco-humeralis</i> , which is well developed, extends from the inner aspect of the coracoid to the internal tuberosity of the humerus, which bone it depresses. Two powerful <i>extensors of the fore-arm</i> arise respectively, (a) from the internal tuberosity, and nearly all the posterior surface of the humerus, and (b) from the outer aspect of the lower end of the scapula; and are inserted separately on the olecranon. The <i>extensor plicæ alaris</i> or coraco-radialis, arises from the clavicular end of the coracoid and inner tuberosity of the humerus, and is inserted on the upper third of the radius and ulna, which it flexes powerfully. Its lower half, which is aponeurotic, and in part elastic, passes through the fold of the wing. Another <i>extensor of the alar membrane</i> arises as a delicate muscular fasciculus from the middle ribs, along with the serratus magnus, and passing through the membrane just named, is inserted on the fascia of the fore-arm, which it flexes. <i>Pronators</i> and <i>supinators</i> of the fore-arm exist, but are very rudimentary. The <i>extensor metacarpi radialis longus</i> extends from
Levator scapulæ.	
Latissimus dorsi.	
Serratus magnus.	
Supra-spinatus.	
Infra-spinatus.	
Subscapularis.	
Deltoid.	
Coraco-humeralis.	
Extensores antibrachii.	
Extensors of the alar membrane.	
Pronators and supinators.	

the outer condyle of the humerus, to be inserted by long tendon on the radial aspect of the rudimentary thumb. The *extensor metacarpi radialis brevis* originates below the former from the ulnar aspect of the radius, and is inserted on the ulnar aspect of the rudimentary thumb. A powerful muscle, representing the *extensor carpi ulnaris*, arises from the outer condyle of the humerus, soon becomes tendinous, and, passing through a groove outside the lower end of the ulna, is inserted on the ulnar metacarpal bone. It flexes the entire carpus, and folds the wing. A small muscle, the *flexor metacarpi radialis*, extends from the anterior aspect of the ulna to be inserted on the dorsal aspect of the radial metacarpal bone, near its head. The *flexor metacarpi ulnaris*, much larger than the last, proceeds from the internal pulley of the ulna to the ulnar carpal and metacarpal bones. The metacarpal region possesses a few imperfectly developed muscles. The rudimentary thumb has *two extensors*, an *abductor*, and an *adductor*. The second digit has *two extensors* and an adductor. The lesser digit has an abductor only.

Extensors of the metacarpus.

Flexors of the metacarpus.

Muscles of the metacarpus.

In the *posterior extremity* of birds we find a considerable number of muscles, which, however, move the limb chiefly in an anterior and posterior direction, adduction and abduction being limited by the form of the acetabulum, and the short and powerful ligamentum teres. The *gluteus externus* is a large, flat muscle, extending from its origin at the union of the iliac bones over the trochanter major, to be inserted on the external lateral ligament of the patella, the head of the fibula, and the fascia of the leg. The *gluteus medius*, a thick, bulky muscle, though much smaller than the last, originates from the fossa of the ilium, and plays over the trochanter major by two tendons, one of which is inserted on the posterior aspect of that process, the other a little lower on the back of the femur. The *gluteus internus* is a small muscular bundle, extending from the lower border of the ilium to the posterior aspect of the trochanter major, over the anterior part of which it plays. The *obturator muscles* are represented by a considerable fleshy mass, originating from the inner aspect of the ischio-pubic bone, passing through the anterior portion of the obturator foramen, from the border of which it gains additional fibres, and becoming inserted on the postero-external aspect of the trochanter major. The *pyriformis* and *geminus* are represented by small slips. A *trifacial muscle*, extending from the outer border of the ilium to that part of the femur corresponding to the trochanter minor externus, seems to represent the iliaens. No homologues of the *psoæ* muscles are found.

Muscles of the posterior extremity.

Gluteal muscles.

Obturator.

Iliacus.

No psoæ muscles.



Triceps  
extensor  
cruris.

Muscles in-  
side the  
thigh.

Posterior  
femoral  
muscles.

Gastrocne-  
mius.

Plantaris.

Extensor  
metatarsi.

Flexor  
longus  
digitorum.

Soleus.

The *triceps extensor cruris* is represented by three powerful muscular bellies, holding positions analogous to those of the same muscles in other animals. The *gracilis* and *sartorius* are represented by two slender filaments, more or less distinct from each other, originating from the lower border of the pubis, and inserted by a long and delicate common tendon on the inner aspect of the patella. The *biceps adductor femoris* are two flattened muscles attached to the lower border of the ischium and the postero-internal aspect of the femur. The *biceps femoris* of man (*triceps abductor*) is represented by a long flattened muscle, extending from the outer aspect of the ilium to the head of the fibula, upon which it is inserted by a rounded tendon, also by a broad flattened muscle, originating from the posterior aspect of the femur in its lower half, and becoming inserted chiefly on the fascia of the leg. The *semitendinosus*, flattened and elongated, originates from the lower border of the ischium, and is inserted by strong aponeurosis on the fascia of the leg, and on the internal aspect of the tibia, with the following muscle. The *semimembranosus* originates from the lower border of the ischium, and is inserted on the inner aspect of the tibia beneath its head.

The *gastrocnemius* is represented by two powerful muscular heads, originating respectively from the internal and external condyles of the femur; the internal likewise arises from the patella with its inferior ligament, and from the crest of the tibia. They end in a common flattened tendon, which is inserted on the lips of the trochlea on the lower end of the tibia, and on the lateral aspects of the head of the metatarsal bone. Continuous with this tendon, inferiorly, is a strong fibrous sheath, extending down the whole length of the metatarsus, and enclosing the tendons of the soleus. A bright red muscular bundle extended along the lower border of the abductor, and distinguished from it by its deeper colour, seems to represent the *plantaris*. It joins the gastrocnemius. An additional *extensor of the metatarsus* and flexor pollicis, a fusiform muscle, situated beneath the gastrocnemius on the inner side of the limb, arises from the posterior aspect of the tibia beneath its head, and is inserted by long tendon on a strong, fibrous sheath behind the tibio-metatarsal articulation. The *flexor longus digitorum*, a fusiform muscle, placed on the inner aspect of the last, originates from the head of the fibula, and is inserted into all the distal phalanges. Its tendon passes through the groove behind the tibia along with those of the soleus. The *soleus* is a complex muscle, partially divisible into several heads, and terminating by

several tendons. It arises from the head of the fibula by two tendons, which embrace between them that of the semitendinosus, also from the femur just above its outer condyle. Its tendon passes through the groove behind the lower end of the tibia, joins that of the peroneus half-way down the metatarsus, and bifurcating, becomes inserted on the first phalanges of the two outer digits. A *flexor of the two external digits* is found on the internal aspect of the last. It is a large muscular mass, imperfectly divisible into two bellies, which arise from the head of the fibula, and terminate in two tendons; these traverse the groove behind the head of the metatarsus, and go to be inserted on the distal phalanges of the two outer digits. The *flexor perforans* is a strong muscle, deeply situated beneath the soleus. It originates from the posterior aspect of the bones of the leg, and from the interosseous ligament; its tendon passes through the groove behind the tibio-metatarsal joint, and, dividing into three, becomes inserted on the distal phalanges of the three anterior digits. The *peroneus longus*, a large muscle, arising from the head of the fibula and from the tibial crest, ends in a tendon, which passes through a groove in the outer maleolus, and joins the tendon of the soleus near the middle of the metatarsus. The *peroneus brevis*, arising from the middle and lower third of the fibula, terminates in a tendon, which, after traversing a groove on the outer maleolus, becomes inserted on the head of the metatarsal bone. It flexes the joint. The *tibialis anticus* is a bulky muscle, arising from the anterior aspect of the head of the tibia, and becoming inserted on the metatarsal bone near its head. The *extensor pedis* is a large penniform muscle, originating from the whole anterior aspect of the tibia, and inserted on the distal phalanges of the three anterior digits.

Flexor of the two outer digits.

Perforans.

Peroneus longus.

Peroneus brevis.

Tibialis anticus.

Extensor pedis.

Several muscles may occasionally be noticed in the metatarsal region, but in an extremely rudimentary condition.

WOODCUTS OMITTED IN THEIR PROPER PLACE IN THIS VOLUME.

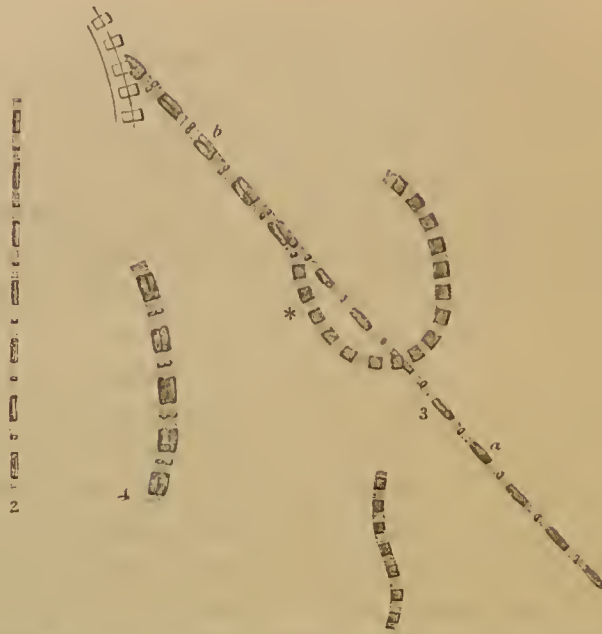


Fig. 195.—MUSCULAR FIBRE—referred to by Dr MARTIN, pages 300, 310.

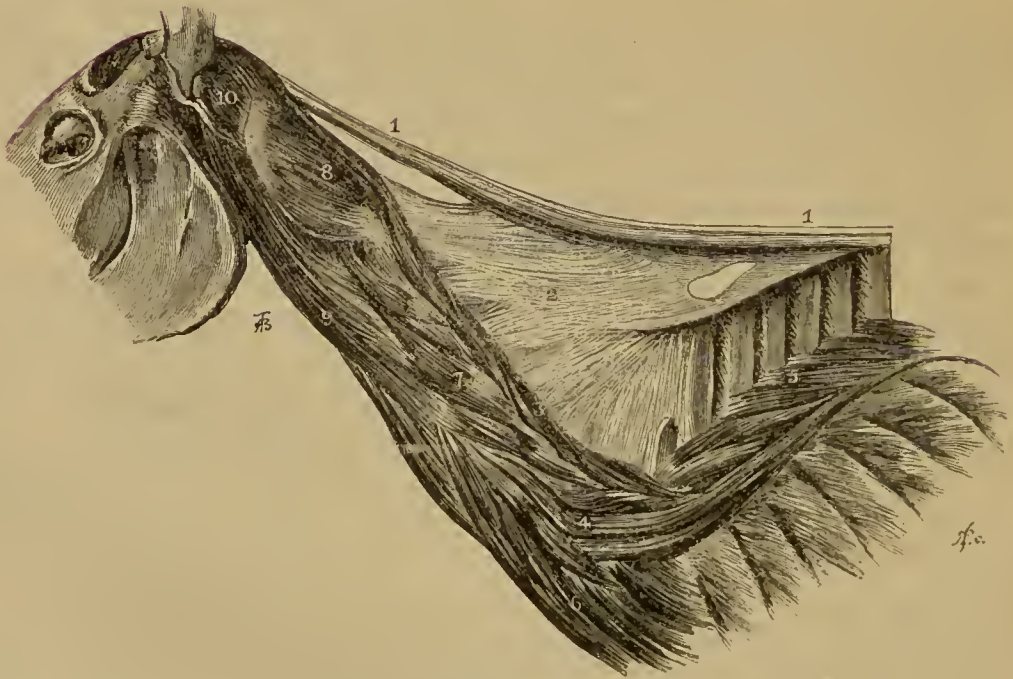


Fig. 196.—DEEP MUSCLES OF THE NECK.—(See page 345).

- |   |                               |
|---|-------------------------------|
| 1. Funicular portion of the ligamentum nuchæ. | 6. Scalenus.                  |
| 2. Laminar portion of the same.               | 7. Intertransversalis colli.  |
| 3. Semispinalis colli.                        | 8. Obliquus capitis posticus. |
| 4. Deep portion of the longissimus dorsi.     | 9. Longus colli.              |
| 5. Semispinalis dorsi.                        | 10. Obliquus capitis anticus. |



# INDEX.

ABDOMINAL tunic, 321  
     ring, external, 323  
     internal, 323  
 Accessory organs. *See* each Organ.  
 Acetabulum, 208  
 Additamentum sutura lambdoidalis, 163  
 Actions of muscles. *See* Muscles.  
 Adipose tissue, 58  
 Agents affecting eiliary motion, 35  
 Amphiarthrosis, 242  
 Amyloid bodies, 25  
 Analyses of bone, 79  
     of diseased bone, 80  
     of synovia, 241  
 Anatomy, comparative, 9  
     definition of, 9  
     descriptive, 9  
     general, 9  
     morbid, 9  
     objects of its students, 9  
 Angular movement in joints, 243  
 Animal cells, 27  
     matter, simple forms of, 24  
     tissues, 17  
         their classification, 17  
 Annular ligaments, 312  
 Anterior foot, bones of, 191  
     limbs in birds, bones of, 232  
     maxillary bones, 146  
 Aponeurosis. *See* Fascia.  
 Apophyses, 78  
 Aqueduct of Fallopius, 140  
 Archiform fibres, 265  
 Areolar tissue, 52  
     its different forms, 53  
     microscopical characters of, 52  
 Arm, bones of, 184  
 Arthrodia, 242  
 Articular cartilage, 238  
     lamella, 237  
 Articulations, 237

Articulations—*continued*.  
     axoido-atloid, 249  
     between the bodies of the vertebræ,  
         244  
     between the cartilages of the false  
         ribs, 259  
     between the first row of carpal bones,  
         269  
     between the lower row of tarsal  
         bones, 300  
     between the pieces of the hyoid bone,  
         255  
     between the pelvis and femur, 288  
     between the second row of carpal  
         bones, 270  
     between the transverse processes of  
         the lumbar vertebræ, 253  
     between the two rows of carpal  
         bones, 270  
     between the two rows of tarsal bones,  
         301  
     calcaneo-astragaloid, 300  
     carpal, 267  
     carpo-metacarpal, 271  
     cervical in birds, 303  
     chondro-costal, 259  
     coccygeal in birds, 303  
     costo-sternal, 258  
         transverse, 257  
         vertebral, 256  
     dorsal and sacral in birds, 303  
     femoro-tibial, 294  
     first and second costo-vertebral,  
         253  
         costo-sternal, 259  
         interphalangeau, 280  
     humero-radial, 262  
     inferior radio-ulnar in carnivora,  
         266  
     intercoccygeal, 252  
     interhyoid, 256

Articulations—*continued*.

- intermetacarpal, 273
- intervertebral of birds, 303
- ischio-pubic, 287
- metacarpo-phalangean, 274
- occipito-atloid, 251, 303
- of birds, 303
- of the head, 253
- of the hip, 288
- of the hyoid bone, 255
- of the spine, 244
- of the tarsus, 295
- of the thorax, 256
- peroneo-tibial, 294
- radio-carpal, 266
  - ulnar, 264
- sacral, 252
- sacro-coccygeal, 252
  - iliac, 285
  - lumbar, 252
  - transverse, 252
- scapulo-humeral, 260
- second interphalangean, 282
- sternal of the ox and pig, 260
- superior radio-ulnar in carnivora, 265
- tarso-metatarsal, 302
- temporo-hyoid, 255
  - maxillary, 253, 304
- thoracic, their movements, 260
- tibio-tarsal, 295
- vertebral, 244

Astragalus, 219

Atlas, 102

Auditory meatus, external, 141  
internal, 140

Back, muscles of the, 328

Ball-and-socket joints, 242

Basilar process of the coffin bone, 202  
suture, 163

Beale's views of cells, 18

Bicipital groove, 186

Birds, skeleton of, 226

Blastema, 18

Blood-vessels of bones, 84  
of muscles, 312

Bodies of the vertebræ, joints between, 244

Bone, general anatomy of, 63

- blood-vessels of, 84
- canaliculi of, 64, 67
- chemical composition of, 78
- classes of, 77
- colour of, 80
- compact or cancellated, 81
- development of, 65, 84
- diploë of, 81
- eminences of, 78
- endosteum of, 84
- Haversian canals of, 81

Bone—*continued*.

- lacunæ of, 63, 81
- lamellæ of, 82
- lamellæ, fibres of, 83
- lymphatics of, 84
- medulla of, 88
- nerves of, 84
- perforating fibres, 83
- periosteum, 84
- processes of, 78
- repair of fractured, 89

Bones, descriptive anatomy of, 95

- anterior maxillary, 146
- astragalus, 219
- atlas, 102
- axis, 104
- calcis, 219
- cannon, 195
- carpal, 191, 233
- cervical vertebræ, 101, 226
- clavicle, 180
- coccygeal vertebræ, 116, 228
- coffin, 200, 223
- coracoid of birds, 232
- coronet, 200, 223
- cranial, 120, 228
- cuboid, 220
- cuneiform, 192
  - magnum, 221
  - parvum, 221

dentata, 104

digital, 198, 223, 233

dorsal vertebræ, 108, 227

ethmoid, 130

facial, 143, 229

femur, 211, 234

fibula, 217, 234

frontal, 126

furcula, 232

humerus, 184, 233

hyoid, 160

ilium, 206, 234

inferior maxillary, 157

innominate, 205, 234

ischium, 208, 234

lachrymal, 149

large metacarpal, 195

metatarsal, 222

sesamoid, 199

lumbar vertebræ, 111

magnum, 193

malar, 151

merrythought, 232

metacarpal, 195, 233

metatarsal, 222, 234

nasal, 148

navicular, 203

occipital, 120, 226

palatine, 152

parietal, 124

pastern, 198, 223

Bones—*continued*.

patella, 217, 234  
 pedal, 200, 223  
 pelvic, 210  
 petrous portion of the temporal, 140  
 pisiform, 193  
 posterior digital in birds, 235  
 pterygoid, 154  
 pubis, 206, 234  
 radius, 187, 233  
 ribs, 174, 231  
 sacrum, 114, 227  
 scaphoid, 192, 220  
 scapula, 181, 232  
 semilunar, 192  
 sesamoids, 199, 203, 223  
 shoulder, 180  
     blade, 181  
 skull, 120  
 small metacarpal, 196  
     metatarsal, 222  
     sesamoid, 203  
 sphenoid, 123  
 splints, 196, 222  
 squamous portion of the temporal  
     bone, 138  
 sternum, 172  
 surfraginis, 198, 223  
 superior maxillary, 143  
 tarsal, 219  
 temporal, 138  
 thigh, 211  
 thoracic of birds, 231  
 tibia, 215, 234  
 trapezium, 193  
 trapezoid, 193  
 tuberos portion of the temporal, 140  
 turbinated, 156  
 ulna, 189, 233  
 unciform, 193  
 vertebra, 100, 226  
 vertebral column, 118  
 vomer, 155

## Bony foramina, 78

system in vertebrate animals, 96  
 tissue, 63

## Breast bone, 172

## Broken bones, repair of, 89

## Bursæ mucosæ, 240

## CADAVERIC rigidity, 314

## Canaliculi, 67, 81

## Canals of Havers, 64, 81

## Cancellated tissue, 81

## Cannon bone, 195

## Carpal articulations, 267

## Carpus, bones of, 191

## Cariniform cartilage, 173

## Cartilage, 60

articular, 238

of incrustation, 238

Cartilage—*continued*.

nutrition of, 62  
 of the scapula, 182  
 ossification of, 62  
 uses of, 63

## Cartilages of the ribs, 177

semilunar of the stifle joint, 291

## Cavity, glenoid, 182

## Cell action, 23

## Cells, 18

Dr Beale on, 18

changes in the substance of, 27

essential constituents of, 22

increase in size of, 27

office of, in secretion, 31

proliferation of, 22

Virchow on, 19

## Cell-wall, Dr Beale's views of, 24

## Centres of nutrition, Goodsir on, 19

of ossification, 85

## Cervical vertebræ, 101, 226

## Changes in cells, 27

in nuclei, 28

of relation between cells, 28

## Chemical changes in cells, 28

composition of bone, 78

of muscle, 313

of pigment granules, 41

nature of nervous tissue, 73

## Ciliary motion, agencies affecting, 35

## Ciliated epithelium, 34

## Circumduction in joints, 243

## Circumferential fibro-cartilage, 238

## Classification of animal tissues, 17

of ductless glands, 74

of joints, 241

## Clavicle in carnivora, 180

## Coccygeal vertebræ, 116

## Coffin bone, 200

## Columnar epithelium, 33

## Compact tissue of bone, 81

## Comparative anatomy, 9

Condyles of bones. *See the Bones.*

## Connecting fibro-cartilage, 238

## Connective tissue, its universal distribution, 49

nature of, 51

## Consistency of horn, 44

## Constituents of a cell, 22

## Continuous development, law of, 21

## Contractility, muscular, 315

Cordiform portion of the ligamentum  
nuchæ, 248

## Cornua of the hyoid bone, 161

## Coronet bone, 199

## Coronoid process of the lower jaw, 158

## Costal cartilages, 177

## Cotyloid cavity, 208

## Cranial bones, 120

cavity, 166

## Cribiform plates of the ethmoid bone, 131



- Crista galli, 131  
 Crural arch, 323  
 Crystals, 27  
 Crystalline granules, 27  
 Crystalline lens, an epidermoid structure, 39  
 Cylindrical epithelium, 33  
 DEFINITION of anatomy, 9  
 Deutata, 104  
 Dentinal tubes, 68  
 Dentine, 68  
 Descriptive anatomy, 9  
 Development, law of continuous, 21  
     of bone, 65, 84  
     of ductless glands, 75  
 Development of the sinuses in the head, 169  
 Diaphragm, 361, 448  
 Diaphysis, 78  
 Diapophysis, 97  
 Diarthrosis, 242  
     rotatorius, 243  
 Diploë, 81  
 Diseased bones, analysis of, 80  
 Dissection, positions given to the subject in, 316  
 Division of cells into fibrils, 28  
 Dorsal vertebræ, 108  
 Ductless glands, development of, 75  
     their classification, 74  
     tissue of, 74  
 Ductus ad nasum, 150  
 ELASTIC tissue, 55  
     its chemical characters, 56  
 Elbow joint, 262  
 Elementary muscular fibres, 307  
 Eminentia patiloba, 201  
 Emissoria Santorini, 84  
 Enarthrosis, 242  
 Endoskeleton, 96  
 Endosteum, 84  
 Ensiform cartilage, 174  
 Epidermic tissue, 29  
 Epidermis, 29  
 Epithelium, ciliated, 34  
     columnar, prismatic or cylindrical, 33  
     fusiform, 34  
     scaly, 37, 38  
     spheroidal, 30  
     tessellated or pavement, 38  
     transitional, 33  
 Epapophysis, 97  
 Essential constituents of a cell, 22  
 Ethmoid bone, 130  
     cells, 131  
 External abdominal or inguinal ring, 323  
 FACE, bones of the, 143  
 Fascia, abdominal, 321  
 Fascia—continued.  
     antibrachial, 400  
     of arm, 400  
     external scapular, 387  
     gluteal, 416  
     lata, 422  
     of leg, 433  
     lumbo-iliac, 336  
     lumborum, 332  
     structure of, 55  
 Fatty molecules, 25  
     tissue, 58  
 Fat, uses of, 60  
 Femoral arch, 323  
 Fibres of osseous lamellæ, 83  
     supposed formation from cells, 28  
 Fibre, simple, 26  
 Fibrils of muscle, 308  
 Fibro-cartilage, 61  
     circumferential, 238  
     connecting, 238  
     as an element of joints, 23  
     interarticular, 238  
     interhyoid, 256  
     intervertebral, 245  
     temporo-hyoid, 255  
 Fixed joints, 241  
 Foot of the horse, horn of the, 43  
 Foramen, condyloid, 122  
     incisivum, 146  
     inferior dental, 157  
     infra-orbital, 145  
     internal orbital, 134  
     labial or mental, 159  
     lacerum basis cranii, 122  
     orbitale, 134  
     magnum, 122  
     obturator, 209  
     opticum, 134  
     palatine, 145  
     patheticum, 134  
     rotundum, 134  
     spheno-palatine, 145  
     stylo-mastoid, 141  
     subsphenoidal, 136  
     superior dental, 145  
     supra-orbital, 127  
 Foramina intervertebral, 101, 104, 110, 114  
     vertebral, 102  
 Fore and hind limbs, correspondence between the bones of the, 223  
 Fore-arm, bones of the, 187  
 Fore-limbs, bones of the, 180  
 Formation of the medullary cavity in bones, 88  
 Form of muscles, 306  
     of the thorax, 179  
 Forms of areolar tissue, 53  
     of glandular elements, 30  
 Frontal bones, 126

- Frontal—*continued*.  
     sinus, 168  
 Fronto-parietal suture, 162  
     sphenoidal suture, 163  
 Fusiform epithelium, 34  
  
 GELATINOUS fibres, 72  
 General anatomy, 9  
     characters of a vertebra, 100  
     conformation of the skull, 163  
 Ginglymus, 243  
 Glandular elements, 30  
 Gliding joints, 242  
     movement in joints, 243  
 Globules, 25  
 Gomphosis, 241  
 Goodsir on centres of nutrition, 19  
     on secreting cells, 30  
 Granules, 24  
     crystalline, 27  
 Growth of horn, 47  
  
 HÆMAL arches of the vertebræ, 96  
     spine, 97  
 Hæmapophysis, 97  
 Hand-books on General and Descriptive  
     Anatomy, 10  
 Haunch, bones of the, 205  
 Haversian canals, 64, 81  
 Hair and wool, 41  
     colour of, 42  
     imbricated scales of, 42  
     structure of, 41  
 Harmonia, 241  
 Head, articulations of, 253  
     bones of the, 120, 228  
 Hind limbs, bones of the, 205  
 Hinge joints, 243  
 Hip joint, 288  
 Histogenic action, 20  
 Histology, 9  
 Histolytic action, 20  
 Horn, 43  
     consistency of, 44  
     growth of, 47  
     its morbid conditions, 47  
     of the horse's foot, 43  
     pigment of, 46  
     secreting papillæ, 43  
 Horny fibres, 43  
 Horse's foot, horn of wall and sole of, 46  
 Humerus, 184  
 Hyoid bone, 160  
     muscles of, 374  
 Hyoidean joints, 255  
 Hypapophysis, 97  
  
 ILIAC fascia, 336  
 Ilio-pectineal ridge, 211  
 Ilium, 206  
 Imbricated scales of hair, 42  
  
 Immoveable joints, 241  
 Inguinal canal, 323  
 Innominate bones, 205  
 Interarticular fibro-cartilage, 238  
 Interhyoid fibro-cartilage, 256  
 Internal inguinal ring, 323  
 Interparietal suture, 163  
 Introduction, 9  
 Intervertebral fibro-cartilage, 245  
     joints, 244  
 Irritability, muscular, 314  
 Ischium, 208  
  
 JOINTS, 237  
     ball-and-socket, 242  
     classification of, 241  
     gliding, 242  
     hinge, 243  
     immoveable, 241  
     intervertebral, 244  
     movements admitted in, 243  
     of the fore limbs, 260  
     of the head, 253  
     of the hind limbs, 285  
     of the thorax, 256  
     of the vertebral column, 244  
     pivot, 243  
     with free movement, 242  
     with limited movement, 242  
  
 KINDS of movement admitted in joints, 243  
 Knee, bones of the, 191  
 Kölliker on secreting cells, 30  
  
 LACHRYMAL bones, 149  
 Lacunæ of bone, 63, 81  
 Lambdoidal suture, 162  
 Lamellæ of bone, 82  
 Lateral ginglymus, 243  
 Law of continuous development, 21  
 Leg, bones of, 215  
 Ligaments in general, 238  
     annular of the radio-ulnar joint, 263  
     anterior carpo-metacarpal, 271  
         common of the carpus, 268  
         common tarsal, 297  
         costo-transverse, 256  
         lateral of the coffin-joint, 283  
     of the first row of carpal  
         bones, 270  
     of the lower row of carpal  
         bones, 270  
     as elements of joints, 238  
     astragalo-metatarsal, 302  
     calcaneo-metatarsal, 301  
     capsular of the articular processes of  
         the vertebræ, 246  
     of the axoido-atloid joint, 251  
     of the chondro-costal joint,  
         259  
     of the costo-sternal joint, 258

Ligaments—*continued*.

- capsular of the elbow, 263
  - of the hip-joint, 289
  - of the lower radio-ulnar joint, 266
  - of the pastern, 277
  - of the patella, 292
  - of the peroneo-tibial joint, 295
  - of the sacro-transverse joints, 252
  - of the shoulder-joint, 261
  - of the stifle, 293
  - of the temporo-maxillary joint, 254
- cotyloid, 288
- enboido-cuneiform, 300
  - interosseous, 300
- scaphoid, 300
  - interosseous, 300
- external lateral of the carpus, 267
  - of the elbow, 262
  - tarsal, 298
  - of the stifle, 292
- inferior axoido-atloid, 250
  - common of the vertebræ, 246
  - sacro-iliac, 286
  - sesamoid, 276
  - sterno-costal, 259
- interarticular of the vertebro-costal joint, 257
- interhyoid capsular, 256
- interlamellar, 248
- internal lateral of the carpus, 267
  - of the elbow, 263
  - tarsal, 299
  - of the stifle, 293
- proper radio-carpal, 267
- interosseous between the lower row of carpal bones, 270
  - between the shafts of the radius and ulna, 266
  - calcaneo astragaloid, 300
  - carpo-carpal, 271
    - metacarpal, 271
  - intercuneiform, 301
  - intermetacarpal, 273
  - of the first row of carpal bones, 270
  - of the lower radio-ulnar joint, 266
  - of the navicular-joint, 282
  - of the peroneo-tibial joint, 295
  - of the radio-ulnar joint, 265
  - of the stifle, 293
  - of the two rows of tarsal bones, 302
  - sacro-iliac, 285

Ligaments—*continued*.

- interosseous scapho-cuneiform, 301
    - tarso-metatarsal, 302
  - intersesamoid, 276
  - interspinous, 248
  - lateral calcaneo-astragaloid, 300
    - metacarpophalangean, 277
    - of the first interphalangean joint, 281
    - of the patella, 292
    - sesamoid, 276
  - maxillæ laterale externum, 254
    - posticum, 254
  - median proper radio-carpal, 267
  - nuchæ, 248
  - odontoid, 249
  - of carpo-carpal joint, 271
  - of the patella, 291
  - of the semilunar cartilages of the stifle, 291
  - of the sternum, 259
  - posterior carpo-metacarpal, 271
    - common of the carpus, 269
    - tarsus, 289
  - costo-transverse, 257
  - lateral of the coffin joint, 283
  - of the carpo-carpal joint, 271
  - tarso-metatarsal, 301
  - pubio-femoral, 289
  - round of the hip joint, 289
  - sacro-sciatic, 287
  - stellate, 257
  - superior axoido-atloid, 250
    - calcaneo-astragaloid, 300
    - common of the vertebræ, 245
    - sterno-costal, 258
    - sacro-iliac, 286
  - supra-spinous, 247
  - suspensory of the pastern, 277
  - teres of the hip joint, 289
  - transverse of the ischio-pubic symphysis, 288
  - transverse of the radius and ulna, 265
  - yellow elastic of the costal cartilages, 259
- Lamina cribrosa, 131
- Limbs, 180
  - homologues of the, 98, 223
  - appendages of the hæmal arches, 98
- Linea alba, 321
- Lineæ transversæ, 326
- Lister, Professor, on the pigment cells of the frog's skin, 41
- Living body, ultimate active element of the, 18
- Lumbar vertebra, 111



Lumbo-iliac fascia, 336  
 Lymphatics of bone, 84  
  
 MALAR bones, 151  
 Masto-occipital suture, 163  
 Maxillary sinus, 168  
 Medullary cavity in bones, formation of, 83  
     spaces, 81  
 Membrane, simple, 26  
 Metacarpal bones, 195  
 Metatarsal bones, 222  
 Microscopical characters of areolar tissue, 52  
 Milk globules, 26  
 Mixed joints, 242  
 Modes by which bones unite with each other, 237  
 Molecular theory, 19, 24  
 Molecules, 24  
 Morbid anatomy, 9  
 Moveable articulations, 242  
 Movements in the thoracic articulations, 260  
 Mucous tissue, 57  
 Muscular contractility, 315  
     fibres, texture of, 307  
     fibrillæ, 308  
     irritability, 314  
     sense, 314  
     sheaths, 307  
     system, 306  
     tissue, 69  
 Muscle, chemical composition of, 313  
     physical properties of, 314  
     vital properties of, 314  
 Muscles, blood-vessels of, 312  
     form of, 306  
     termination of nerves in, 313  
     use of, 306  
     descriptive anatomy of, 317  
     abdominal, 320, 448  
     abductor brachii, 387  
         minimi digiti, 414, 446  
         oculi, 385  
         of the arm, 387  
         pollicis, 414  
         tibialis, 444  
     adductor brachii, 393  
         brevis cruris, 426  
         femoris, 428  
         indicis, 414  
         longus cruris, 425  
         oculi, 385  
         pollicis manus, 414  
     anconeus, 400  
     antea spinatus, 389  
     anterior anti-brachial, 400  
         brachial, 401  
         conclæ, 382  
         femoral, 422

*Muscles—continued.*

    anterior humeral, 393  
         small serrated of the back, 330  
         tibial, 439  
     aryteno-pharyngeus, 380  
     atloido-mastoideus, 346  
         occipitalis, 346, 347  
         styloideus, 353  
         suboccipitalis, 352  
     attollens anterior, 381  
         maximus, 382  
         posterior, 383  
     auricular, 381  
     axillary, 354  
     axoido-atloideus, 346  
     azygos uvulae, 380  
     basio-glossus, 377  
     behind the fore-arm, 405  
     biceps abductor femoris, 452  
         brachialis, 394  
     bifemoro-calcanæus, 440  
     biventer cervicis, 447  
     brachialis anticus, 396  
     calcanæo-phalangeus, 445  
     caninus, 367  
     caput magnum of the triceps extensor brachii, 398  
         medium of the triceps extensor brachii, 398  
         parvum of the triceps extensor brachii, 399  
     cervicalis ascendens, 447  
     cervical trapezius, 341  
     cervico-acromialis, 341  
         auricularis inferior, 383  
         medius, 382  
         superior, 382  
         subscapularis, 342  
         tracheleus, 342  
     circumflexus palati, 380  
     coccygeal, 339  
     complexus, 343, 447  
         major, 343  
         minor, 344, 346  
     compressor coccygis, 340  
     constrictor pharyngeus anterior, 379  
         medius, 379  
         posterior, 379  
     coraco-brachialis, 393  
         humeralis, 393, 450  
         radialis, 394  
     corrugator supercilii, 384  
     costal, 357  
     costo-abdominalis, 322  
         sternalis, 359  
         subscapularis, 358  
         tracheleus, 353  
     erico-pharyngeus, 379  
     crureus, 423, 424  
     cubito-phalangeus, 400

*Muscles—continued.*

curvator-coccygis, 340  
 deltoid, 450  
 depressor alae nasi, 368  
     anguli oris, 368  
     coccygis, 340  
     labii inferioris, 368  
     oculi, 385  
 diaphragm, 361, 448  
 digastricus, 374  
 dorsal trapezius, 328  
 dorso-acromialis, 328  
     humeralis, 329  
     mastoideus, 344  
     occipitalis, 343  
     spinalis, 345  
     subscapularis, 330  
 epicondylometacarpus, 406  
     phalangeus, 407  
     supercarpus, 406  
 epitrochlo-premetacarpus, 401  
     prephalangeus, 402  
     supercarpus, 405  
 erector coccygis, 339  
 extensor carpi communis digitorum,  
     402  
     radialis, 401  
     ulnaris, 451  
 extensor indicis, 411  
     metacarpi anterior, 401  
     maguus, 401  
     obliquus, 402  
     radialis brevis,  
         451  
     longus,  
         450  
     metatarsi, 452  
     minimi digiti, 404  
     of the alae membrane, 450  
     of the internal digit in  
         the ox, 403  
     pedis, 402, 453  
     phalangeus lateralis, 404  
     plicae alaris, 450  
     proprius pollicis et indi-  
         cis, 411  
     secundi internodii pollicis,  
         411  
     suffraginis, 404.  
 extensoris antibrachii, 450  
 external intercostals, 359  
     oblique, 322, 448  
     obturator, 421  
     straight, of the eye, 385  
     scapular, 386  
 fascial, 369  
 fascia lata, 422  
 femoro-phalangeus, 441  
     tibialis obliquus, 444  
 flexor brevis digitorum, 441  
     minimi digiti, 414, 415

*Muscles—continued.*

flexor brevis pollicis manus, 414  
     capitis brevis, 352  
         longus, 352  
         parvus, 353  
     digitis obliquus, 444  
     longus colli, 354  
         digitorum, 452  
         pollicis pedis, 442  
 metacarpi externus, 405  
     internus, 406  
     medius, 406  
     obliquus, 406  
     radialis, 457  
     ulnaris, 451  
 metatarsi, 437  
 of the two outer digits in car-  
     nivora, 453  
 pedis accessorius, 444, 446  
     perforans, 408, 442, 453  
     perforatus, 407, 441  
 gastrocnemius, 440, 452  
     externus, 441  
     internus, 441  
 gemini, 421, 451  
     tibialis, 440  
 genio-hyoideus, 375  
     hyoglossus, 378  
 gluteal, 416  
 gluteus externus, 416, 451  
     internus, 419, 451  
     magnus, 416, 418  
     maximus, 418  
     medius, 416, 418, 451  
     minimus, 419  
     minor, 416  
 gracilis, 426, 452  
     anterior, 424  
     internus, 422  
 great oblique of the eye, 386  
 humeralis externus, 396  
 humero-olecranius externus, 399  
     internus, 399  
     minor, 400  
 humero-radialis, 396  
 humero-sterno-mastoideus, 349  
 hyoglossus brevis, 377  
     longus, 377  
     parvus, 378  
 hyoid, 374  
 hyoideus, 351  
     magnus, 375  
     parvus, 376  
 hyo-pharangeus, 379  
 iliacus, 338, 451  
 ilio-abdominalis, 325  
     aponeuroticus, 422  
     costalis, 334  
     femoralis, 424  
     rotuleus, 423  
     trochantineus, 338

*Muscles—continued.*

- ilio-trochantineus magnus, 418
  - medius, 416
  - parvus, 419
- inferior cervical, 347
  - oblique of the eye, 386
  - straight of the eye, 385
- infra spinatus, 390, 450
- intercervicalis, 345
- intercostalis communis, 334
- intercostals, 359, 418
- internal femoral, 425
  - intercostals, 360
  - levator of the upper eyelid, 384
  - oblique, 325, 448
  - scapular, 391
  - straight of the eye, 385
- interosseous metacarpal, 413, 415, 416
  - metatarsal, 445
- intertransversales, 447
  - colli, 345
  - lumborum, 339
- ischio-coxigeus, 340
  - femoralis, 422
  - trochanterius, 421
- kerato-glossus, 377
  - hyoideus parvus, 376
  - pharyngeus, 379
- lachrymalis, 366
- lachrymo-labialis, 366
- lateralis sterni, 359
- latissimus dorsi, 329, 450
- levatores costarum, 360
- levator humeri, 349
  - labii superioris, 366
    - alæque nasi, 366
  - menti, 368
  - oculi, 385
  - palpebræ superioris externus, 384
  - scapulæ, 450
- lingual, 377
- lingualis, 378
- longissimus dorsi, 332
- longus colli, 354, 447
- lumbrici, 413, 415, 445
- masseter, 370
- mastoido-auricularis, 383
  - humeralis, 349
- maxillaris, 366
- maxillo-labialis, 368
- mento-labialis, 368
- mylo-hyoideus, 375
- myrtiformis, 368
- nasalis brevis, 367
- obliquus capitis anticus, 346
  - posticus, 346
- externus abdominis, 322

*Muscles—continued.*

- obliquus inferior oculi, 386
  - internus abdominis, 325
  - magnus oculi, 386
  - parvus oculi, 386
  - superior oculi, 386
- obturator externus, 421, 451
  - internus, 420, 446
- of the anterior foot, 412
- of the ear, 381
- of the external scapular region, 386
- of the eyelid, 383
- of the foot in carnivora, 413
- of the foot in the pig, 415
- of the fore-arm in carnivora, 411
- of the fore-limbs, 386
- of the haunch, 416
- of the hind-limbs, 416
- of the palate, 380
- of the palpebræ, 383
- of the pharynx, 378
- of the posterior foot, 445
- of the posterior brachial region, 405
- of the ribs, 357
- of the tongue, 377
- of the tail, 447
- of the wing, 449
- opponens minimi digiti, 415
  - pollicis manus, 414
- orbicularis palpebrarum, 384
- orbito-palpebralis, 384
- palatal, 380
- palato-glossus, 378
  - pharyngeus, 381
  - staphyleus, 380
- palmaris brevis, 414
  - longus, 406
- palpebral, 383
- panniculus carnosus, 318
- parotido-auricularis, 383
- pectineus, 426
- pectoral, 354, 449
- pectoralis magnus, 355, 356
  - minor, 356
  - parvus, 355, 357
  - prescapularis, 357
  - profundus, 356
  - superficialis, 355
  - transversus, 355
- peristaphyleus externus, 380
  - internus, 380
- peroneo-calcaneus, 441
  - phalangeus, 444
- peroneus brevis, 453
  - longus, 439, 440, 453
  - tertius, 437
- pharyngeal, 378
- pharyngo-glossus, 378
  - staphyleus, 381
- plantaris, 441, 452
- popliteus, 444



*Muscles—continued.*

- postea spinatus, 390
- posterior conchæ, 383
  - humeral, 397
  - small serrated of the back, 331
  - straight of the eye, 384
  - tibial, 440
- prouator quadratus, 411
  - teres, 411
- psoas magnus, 337
- pterygoideus externus, 372
  - internus, 372
- pterygo-pharangeus, 379
- pyramidalis, 420
  - nasi, 367
- pyriformis, 420, 451
- quadratus lumborum, 338
  - femoris, 422
- radialis accessorius, 410
- radio-phalangeus, 408
  - premetacarpeus, 402
  - prephalangeus, 404
- rectus abdominis, 326, 448
  - capitis anticus major, 352
    - minor, 352
    - lateralis, 353
    - posticus major, 346
      - minor, 347
  - externus oculi, 385
  - femoris, 423
  - inferior oculi, 384
  - internus oculi, 385
  - of the head, 447
  - posterior oculi, 384
  - superior oculi, 385
- retractor oculi, 384
- retrahens, 382
- rhomboideus anterior, 342, 450
  - brevis, 330
  - longus, 342
    - posterior, 330
- saero-occygeus inferior, 340
  - lateralis, 340
  - superior, 339
- costalis, 338
- trochanterius, 420
- sartorius, 425, 452
- scalenus, 353
- scapular part of the deltoid, 387
- scapulo-humeralis gracilis, 393
  - magnus, 387
    - minor, 389
  - olceranius longus, 397
    - major, 398
  - ulnaris, 397
- seuto-auricularis externus, 382
  - internus, 383
- seminembranosis, 452
- semispinalis colli, 345, 447
  - dorsi et lumborum, 334, 446

*Muscles—continued.*

- semitendinosus, 452
- serratus magnus, 358, 450
  - parvus anticus, 330
    - posticus, 337
- small oblique of the eye, 386
- spheno-maxillaris, 372
- soleus, 441, 452
- spinalis brevis, 345
  - dorsi, 447
- splenius, 342
- staphyleus, 380
- sternalis, 360
- sterno-aponeuroticus, 355
  - costalis, 360
  - humeralis, 355
  - hyoideus, 357
  - nastoides, 350
  - maxillaris, 350
  - pubialis, 326
  - thyro-hyoideus, 351
  - trochineus, 355
  - pharyngeus, 381
- stylo-hyoideus, 376
  - maxillaris, 374
  - staphyleus, 380
- subacromio-trochiterius, 390
- subdorso-atloideus, 354
- sublumbo-pubialis, 337
  - tibialis, 425
  - trochanterius, 337
- subpubio-femoralis, 426
  - tibialis, 426
  - trochanterius externus, 421
    - internus, 420
- subscapularis, 391, 450
- subscapulo-humeralis, 393
  - hyoideus, 351
  - trochineus, 391
- supracromio-trochiterius, 389
- superficialis costarum, 330
- superior cervical, 341
  - dorso-lumbar, 323
- super-maxillo labialis, 366
  - nasalis magnus, 367
    - parvus, 367
  - nasalis-labialis, 366
- superior oblique of the eye, 386
  - straight of the eye, 385
- supinator longus, 411, 450
  - brevis, 411
- supra-costalis, 360
- spinatus, 389
- tarso-prephalangeus, 415
- temporalis, 371
- temporo-auricularis externus, 382
  - internus, 383
    - maxillaris, 371
- tensor-palati, 380
  - vaginae femoris, 422
- teres externus, 389

*Muscles—continued.*

- teres internus, 393
    - major, 393
    - minor, 389
  - third pectoral in birds, 449
  - thyro-pharyngeus, 379
  - tibialis anticus, 438, 453
    - posticus, 444
  - tibio-phalangeus, 442
    - premetatarsus, 437
  - trachelo-mastoideus, 344, 447
    - suboccipitalis, 352
    - subscapularis, 358
  - transversalis abdominis, 327, 448
    - costarum, 334, 359, 360
    - hyoideus, 376
    - nasi, 367
  - trapezius, 341, 449
  - triangularis scapulae, 358
    - sterni, 360
  - triceps extensor cruris, 423, 452
    - cubiti, 398
    - extensor brachii, 398
  - ulnaris accessorius, 410
  - vastus externus, 424
    - internus, 423
  - zigomatico-auricularis, 381
  - zigomato-labialis, 365
    - maxillaris, 370
- Musculo-spiral groove, 184
- Mylo-hyoidean ridge, 158
- NASAL bones, 148
- Nasal fossæ, 167
- Nature of connective tissue, 51
- Navicular bone, 203
- Nerve fibres, 72
- Nerves of bone, 84
  - their modes of termination in muscle, 313
- Nervous tissue, 71
  - its chemical composition, 73
- Neural arches of the vertebræ, 96
  - spinæ, 97
- Neurapophysis, 97
- Note to frontispiece, 90
- Nuclear fibres, 54
- Nuclei, changes in, 28
- Nutrition, Goodsir on the centres of, 19
  - of cartilage, 62
- OBJECTS for which anatomy is studied, 9
- Occiput, 120
- Occipital protuberance, 122
- Occipito-parietal suture, 162
- Office of cells in secretion, 31
- Olecranon, 189
- Ossa triquetra, 123
- Ossaceous lamellæ, 82
  - their fibres, 83
- system, 77
- Ossaceous tendons in birds, 446
  - tissue, 63
- Ossification of cartilage, 62
- PALATE, muscles of, 380
- Panniculus adiposus, 59
- Parallel drawn between the bones of the fore and hind limbs, 223
- Patella, 217
- Pavement epithelium, 38
- Pelvis, bones of the, 210
- Penniform muscles, 307
- Periosteum, 84
- Phalanges, bones of the, 198, 223, 233, 235
- Pharynx, muscles of the, 378
- Physical properties of muscle, 314
- Pigment, 40
  - granules, chemical composition of the, 41
  - of horn, 46
- Plantar cushion, 203
- Pleurapophysis, 97
- Posterior foot, bones of the, 218, 234
- Poupart's ligament, 323
- Preplatular fissure, 201
- Prismatic epithelium, 33
- Proliferation of cells, 22
- Pyramidal process of the coffin-bone, 202
- RADIUS, 187
- Relative mobility of the limbs in man and quadrupeds, 244
- Repair of fractured bone, 89
- Resemblance of the bony structure of the fore and hind limbs, 223
- Rete Malpighii, 39
  - mucosum, 39
- Retrossal process, 202
- Ribs, 174
  - cartilages of, 177
- Rigor mortis, 314
- Rotatory movement in joints, 244
- Sacro-sciatic ligament, 287
- Sacrum, 114
- Sagittal suture, 163
- Sarcolemma, 311
- Sarcous elements, 309
- Scaly epithelium, 37, 38
- Scapula, 181
  - cartilage of, 182
- Schizodysplasia, 241
- Secreting cells, Goodsir on, 30
  - Kölliker on, 30
- Semilunar cartilages, 291
  - crest of the coffin-bone, 201
- Semilunar sinus of the coffin-bone, 203
- Sheaths of muscles, 307
- Simple fibre, 26
  - forms of animal matter, 24
  - membrane, 26

- Sinuses of the head, 169  
 Skeleton, its fundamental parts, 95  
     its uses, 95  
 Skull, bones of the, 120, 228  
 Smooth museular tissue, 69  
 Sphenoidal sinus, 169  
 Spheroidal epithelium, 30  
 Splint bones, 196  
 Squamo-parietal suture, 163  
 Squamous suture, 163  
 Starch granules, 25  
 Stifle, 290  
 Striated museular fibre, 70  
 Structures entering into the formation of  
     joints, 237  
 Structure of fasciæ, 55  
     of hair, 41  
 Subcutaneous musecle, 317  
 Suspensory ligament, 277  
 Sutura dentata, 241  
     limbosa, 241  
     serrata, 241  
     squamosa, 241  
 Sutures, 241  
     of the head, 162  
 Symphysis, 242  
 Synarthrosis, 241  
 Synovia, 240  
     analysis of, 241  
 Synovial bursa, 240  
     fringes, 239  
     membranes, as elements of joints,  
         238  
     there, 240  
 Syntonin, 313  
  
 TEMPORAL fossa, 166  
 Temporo-hyoid fibro-cartilage, 255  
 Tendo-Achilles, 441  
 Tendons, 312  
     there, 312  
  
 Tessellated epithelium, 38  
 There, of tendons, 312  
 Thigh, bones of the, 211  
 Thorax, bones of the, 172, 231  
     general form of the, 179  
 Tissue of ductless glands, 74  
 Tissues, classification of animal, 17  
     composed of cells only, 29  
 Tongue, muscles of the, 377  
 Transitional epithelium, 33  
 Transverse suture, 163  
 Tunica abdominalis, 321  
 Typical cervical vertebra, 105  
     vertebra, its adaptations, 97  
  
 ULTIMATE active element of a living body,  
     18  
 Unstriated museular fibre, 69  
 Uses of fat, 60  
  
 VARIETIES of bones, 77  
 Vascularity of bones, 84  
 Vertebrae, cervical, 106  
     composing the skull, 170  
     coccygeal, 116, 228  
     dorsal, 108, 227  
     lumbar, 111  
     sacral, 114, 227  
 Vertebral column, 99, 226  
     as a whole, 118  
 Virchow on cells, 19  
 Vital properties of musecle, 314  
  
 WHITE fibrous tissue, 53  
     its reproduction, 55  
 Wing bones, 232  
 Wool and hair, 41  
 Wormian bones, 123  
  
 YELLOW cartilage, 61  
     elastic tissue,



## ERRATA.

---

- Page 25, 10th line from bottom, *for* clearage, *read* cleavage.
- " 121, 7th line from bottom, *omit* "pass the mastoid processes."
- " 132, 17th line from top, *for* twelve, *read* ten.
- " " 18th line from top, *for* four, *read* two.
- " 168, 7th line from top, *for* inferior, *read* anterior.
- " 188, 7th line from bottom, *for* internal, *read* external.
- " " 6th line from bottom, *for* external, *read* internal; *and for* internal, *read* external.
- " " 3rd line from bottom, *for* external, *read* internal.
- " 189, top line, *for* internal, *read* external.
- " 200, 12th line from bottom, *for* tendons of the perforatus, *read* anterior lateral ligaments of the coffin joint.
- " 234, 5th line from bottom, *for* metacarpal, *read* metatarsal.
- " " 6th line from bottom, *for* metacarpus, *read* metatarsus.
- " 262, bottom line, *for* internal, *read* external.
- " 350, 14th line from bottom, *for* ensiform, *read* cariniform.
- " 352, 13th line from top, *for* splenius, *read* scalenus.
- " 434, 16th line from bottom, *for* flexor, *read* extensor.

